MAXIMS OF PUBLIC HEALTH

O. W. WIGHT

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MAXIMS OF PUBLIC HEALTH.

BY

O. W. WIGHT, A. M., M. D.,

HEALTH OFFICER OF DETROIT.

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PREFACE.

I WILL try, as clearly as possible, to give some general notion of what this book contains.

I have written for the people, rather than for sanitarians; for laymen, rather than for the medical profession. Yet the weary, perhaps discouraged, health-officer may find herein a stimulus to effort and a condiment to more substantial hygienic food; and the busy practitioner of medicine may glean needful information more easily than from the ponderous treatises in which, it is to be hoped, his library abounds. The intelligent householder who has no time, probably no inclination, for systematic studies, may read herein, as he runs, and find hints that will save himself and his loved ones from unspeakable pain and sorrow. John Simon, the prince of sanitarians, says: "Two gigantic evils stand conspicuous: first, the omission (whether through neglect or through want of skill) to make the due removal of refuse matters, solid and liquid, from inhabited places; and, secondly, the license which is permitted to cases of dangerous infectious diseases to scatter abroad the seeds of their in-

fection. In certain very important cases, injury—immense injury—accruing to the public health, arises from a co-operation of these two evils; arises, namely, through the special facility which certain forms of local uncleanliness provide for the spreading of certain specific infections; and the influence which uncleanliness almost necessarily exerts in that way against the public health makes so large an addition to the influence which it exerts in other ways, that, in total power, uncleanliness must, I think, without doubt, be reckoned as the deadliest of our present removable causes of disease."

The plague, Asiatic cholera, typhus fever, typhoid fever, diphtheria, scarlatina, yellow fever, small-pox, and some other infectious diseases belong to the same class. The plague, that has frequently decimated mankind, still lingers in an endemic form among the haunts of misery, want, ignorance, and degeneracy of race. It leaps from its lair when unobstructed, and invades the homes of the intelligent and well-to-do classes by infection. It has been declared, by the perversity, the ignorance, the assumption, or something worse, of a small but noisy and persistent part of the medical profession, to be non-infectious, and has been left to spread and destroy mankind. It was regarded in former times as a mysterious visitation of Divine Providence, and consequently no measures were taken to arrest its course. Other diseases, now more prevalent, are regarded by many in the same light, and therefore the sanitarian of to-day has to deal with the stubborn apathy of superstition.

Typhus fever is nearest of kin to the plague. While it persists in the midst of poverty, filth, and overcrowding in the Old World, it has fortunately never prevailed to any great extent in our American centers of population. Typhoid fever is a member of the same family, and is too well known in all lands. Malignant cholera is a "tramp" from the same epidemic family, but has fortunately been greatly restricted in its wanderings by a more intelligent quarantine and by increased cleanliness. Yellow fever is first cousin to the plague, and will continue to desolate certain portions of this country till our Southern cities practice sanitation better, and the Federal Government undertakes the duty of preventing its periodic importation. Diphtheria, like the plague, feeds on filth and is propagated by infection. Scarlatina is the more fervid, but not less malignant, sister of diphtheria. Both knock at our doors with murderous hands, and will not leave till sanitary administration is allowed to enforce with more vigor the isolation and cleanliness taught by advancing sanitary science. Small-pox is the "Wandering Jew" of the epidemic family; but human ingenuity has tamed its destructive spirit with the cunning of vaccination. Here, again, cleanliness and isolation can do the rest.

It can not too often be repeated: the whole family of the epidemic foes of mankind can be banished by isolation and cleanliness. The coarser plague goes first; then, one after another, the rest. And, by the same means, the other conditions of health and well-being will be greatly improved. Therein, as Simon

nobly says, lies the chief work of sanitation. The greater portions of this book are devoted to the practical problems of combating infectious diseases and the removal of the filth-conditions in the midst of which they flourish. The profession and the public must be educated to appreciate the necessity of using the best methods.

All the diseases belonging to the epidemic family are not discussed in detail. Diphtheria, scarlatina, cholera, small-pox, and others that are prevalent in this latitude, have received careful attention. Of course, discussions of these diseases have been limited to considerations of preventive measures. The field of curative medicine has not been invaded. Administrative, as well as sanitary, methods of combating contagious maladies have been presented with the fullness and earnestness demanded by an awfully important subject.

I have not contented myself with urging the removal of filth, but have given recommendations which, if followed, will prevent the existence of filth within inhabited areas. The abundant organic wastes resulting from our household and manufacturing life are soon transformed into filth by putrefactive decay. With all the energy I could command I have advocated the removal of such wastes *before* their transformation into filth, and have pointed out the ways whereby it can be done. The problem of removing from human habitations matters manufactured by decay into filth-poison involves grave questions of sewering towns, draining inhabited places, plumbing

houses, etc. The principles that must be followed to prevent accumulations of filth have been herein much more amply discussed than mechanical appliances and engineering devices. The only way to get rid of sewer-gas is not to make any. The only way to avoid filth, in gaseous, liquid, or solid form, is to leave nothing around, even for an hour, to putrefy. All the infectious diseases are nourished, if not created, by putrefactive decay. Sanitary engineering is behind science, behind enlightened public demand, when it neglects preventive methods.

Growing out of discussions of the two great evils of uncleanliness and infection, so graphically stated by Mr. Simon, arise considerations of the germ-theory of disease. Avoiding dogmatism, making no pretension to original views, I have simply endeavored, by various forms of statement, explanation, and illustration, to make clear to the non-scientific mind what is meant by the term. The subject recurs in connection with various topics.

The subject of "offensive trades," technically so called, is treated, here and there, not fully enough for the guidance of a board of health in its administrative work, but sufficiently to teach the citizen his common-law rights to enjoy a reasonably quiet and healthy home. Some points of the law of nuisance are given, for the purpose of pointing out to suffering people the proper method of redress in places where no sanitary authority has been established by State or municipal enactments.

Many things have been touched, some with a

gentler, some with a firmer hand, which need not be enumerated here.

I have given the results of six years of personal experience in sanitary administration, in a somewhat desultory form, dwelling most upon those things that are practically of greatest importance, and least upon those things that are purely speculative. The reader, in order to find all that has been said upon any subject, will need to consult the index. This is not a systematic treatise. Sequence is in some measure wanting. The sections are numbered, but have no other heading. Conclusions, not processes, have been given. The concrete method has been preferred to the analytical, as better adapted to minds not trained to scientific investigation. In short, I have attempted to make gravely important sanitary matters interesting as literature. About the success of the attempt I am not over-sanguine.

In addition to the original matter, passages in my reports, written and printed for local use, have been here reproduced, but reshaped and adapted to general publication. These passages, lost in a mass of statistics and special discussions of municipal measures, are really new to the public.

May this little "ounce of prevention" save, for some, many "pounds of cure."

O. W. WIGHT, A.M., M.D.

DETROIT, *July, 1884.*

MAXIMS OF PUBLIC HEALTH.

I.

"It has been proved over and over again," says Dr. Parkes, "that nothing is so costly in all ways as disease, and that nothing is so remunerative as the outlay which augments health, and, in doing so, augments the amount and value of the work done." Playfair, whose statistics are regarded as of great value, tells us that there are twenty-eight cases of sickness to every death. Let us reduce the estimate to a minimum of twenty. At a low calculation, each case of sickness represents a loss of fifty dollars to the State or to the community taken as a whole. Every unnecessary death, and the twenty concurrent cases of unnecessary sickness, therefore, represent a public loss of one thousand dollars. In other words, the community is on that account so much the poorer. Dr. W. E. Boardman, in a careful and elaborate paper contributed to the "Sixth Annual Report of the Massachusetts State Board of Health," demonstrates that the annual loss to that commonwealth by preventable

sickness is considerably more than three millions of dollars. The loss to the people of the United States thereby is not less than the interest on the national debt. Every dollar wisely spent for the preservation of the public health is returned ten-fold, sometimes a hundred-fold, to the community. "It is," says Dr. Farr, "as certain that a high mortality can be reduced, by hygienic appliances, down to a certain limit, as it is that human life can be sacrificed." And above all material saving, is the far higher consideration, the divine economy, of human suffering. "The hope," again says Dr. Farr, "of saving any number of human lives by hygienic appliances is enough to fire the ambition of every good man who believes in human progress."

II.

In sanitation it must not be forgotten that there is an immeasurable distance between organic and organized matter. In passing from the former to the latter, chemistry affords us no aid. Give the chemist a handful of sound wheat and also an equal handful of ground wheat. His science can not tell the difference between the two. The dead elements of the one are exactly equal, in quantity and quality, to the dead elements of the other. Yet, from another point of view, how different are the two! The handful of unground wheat, the organized wheat, has within it the power to multiply itself, under favorable circumstances, till it covers the world with harvests. The ground wheat may nourish an animal or a plant, or

it may mingle with the inert elements of the earth, but under no conditions can it multiply itself. You may give the chemist some healthy unbroken eggs and also some crushed eggs. As chemist, he can not discover the difference between the two. Both furnish to him the same elements. Yet there is a chasm between them as wide as the bourne between life and death. The whole eggs, under favoring conditions, will hatch, produce animals of their kind, which may at length people whole continents. The broken eggs have ended their existence, except as lifeless matter, which may enter into an endless series of other forms, but they can never "increase and multiply." This is what makes the germ-theory of infectious diseases so important. The germs, being organized matter, may increase, like the whole wheat or the unbroken eggs, in geometric ratio. No other theory can wholly account for the devastating epidemics that rapidly sweep over large regions of the inhabited parts of the globe. Under favoring conditions of season, temperature, moisture, perhaps electricity, or more subtile elements, the germs of yellow fever, cholera, scarlet fever, the plague, and other zymotic diseases, that otherwise would remain dormant or have only a feeble growth, may multiply myriads and myriads of times, decimating the population of whole nations. Then mankind reap the benefits arising from the absence of filth which nourishes above all things else the growth of these invisible foes of life. Then we need the resisting vigor of health that comes from cleanly habits of living.

III.

The average cost of educating a child at school—food, clothing, home care, tuition—all things included, is not less than one hundred and fifty dollars a year. The unsanitary conditions of school-buildings neutralize the work of education to the extent of at least one third. The foul air of unventilated and crowded school-rooms, the unequal heating, the poisonous sewer-gas in the outhouses or in the building, cause depression, loss of energy, nervous irritability, dullness of brain, waste of time from ill-health, which increase the friction and slacken the speed of educational progress more than one third. But call the loss one third, which is certainly a minimum. Now, one third of the yearly cost of one hundred and fifty dollars is fifty dollars. The number of children at school in a city of one hundred thousand inhabitants is about twenty thousand. The loss on the whole number, therefore, amounts to the enormous sum of one million dollars per annum. The loss falls on the parents of the children, distributed throughout the city. And this is not all. The habit of dullness, begotten by the unsanitary conditions of school-buildings, lasts during life, and more or less cripples the productive energy of each generation of citizens. Moreover, this vital question touches the pride and hope of almost every household. We must reckon also the cost of increased sickness, and a larger percentage of death. It seems heartless to dwell upon the economic side of such a great and important sub-

ject. Above all, and beyond all, are human suffering, constitutions broken for life, seeds of disease early sown, pain too deep for tears in the panting breast of many a little one, the heartache of parents, the shroud, the emblems of mourning, the solemn "dust to dust" and "ashes to ashes," closing blighted careers which sanitary wisdom might have prolonged over the customary years of usefulness.

IV.

The preservation of the public health, before the nineteenth century, was an unknown or forgotten art among Christian nations. The hygienic formula of the old Greek, Hippocrates, "Pure air, pure water, and a pure soil," was scarcely less comprehensive than the sanitary commands of Moses. The best modern science confirms the wisdom of the heathen physician, and not even the Hon. Robert Ingersoll has discovered any sanitary mistakes made by the Hebrew lawgiver. The Saracens practiced temperance and cleanliness during the Middle Ages, and consequently suffered less from epidemics than the dirty and drunken Christians of Europe.

The new era, in which the State assumes the guardianship of the public health, is bright with promises of physical good to Christian peoples. It was a great preacher of the gospel of Christ who declared "Cleanliness to be akin to Godliness." Hygienic redemption of bodies is next in personal importance to spiritual redemption of souls. Fortunately, it is no longer

fashionable in the church to mortify the flesh with visible or invisible vermin. The "black death" was not a good means of grace even in the days of Procopius, Boccaccio, or De Foe.

V.

The Greek brigand and revolutionist, Theodore Kolokotrones, speaking from bitter experience, complained in his "Memoirs" "of the suffering caused by the filth of long-worn garments as rivaling the pangs of hunger." Through several miles of sewers in the skin are daily eliminated from the body about thirty ounces, nearly two pints, of liquid waste, two and one half per cent of which may be reckoned as solid matter. The excrement from the skin, when undergoing putrefactive decomposition, is quite as poisonous as the excrement from the kidneys or from the intestines. The two pints daily of excreta from the integument of the body rapidly saturate the clothing. Dirty linen in an unventilated closet will soon become as offensive and dangerous as an unclean urinal or water-closet. The excrement saturating clothes worn too long without washing putrefies and makes the person offensive. This is the reason why a room filled with people will in a brief time smell like a charnel-house, if not thoroughly ventilated. The body in a few days will become smeared all over with the decomposing waste. People will live, and eat, and sleep, go to church, move about the streets, frequent assemblies, attend parties, get into public conveyances, and oc-

cupy their places of business, with unwashed skins, clothed in unwashed garments, not even suspecting that, from a sanitary point of view, they are as unclean as the idiot who does not know enough to obey the calls of nature. A sponge-bath every morning is a necessity of decent living. We ought to be grateful to the Mohammedans for teaching dirty Christian Europe to wash herself. Water from the wash-tub and the bath-tub belongs with sewage, and requires the same care in its disposal as in the disposal of the contents of water-closets. The Greek brigand was right: a dirty shirt is as bad as hunger. Mr. Emerson says truly that the best of us had rather eat with a washed sinner than with a dirty saint.

VI.

A public sanitary conscience can be created only by the enactment and enforcement of wise sanitary laws. "I have given it as my deliberate opinion," says Alexander Bain, "that authority or punishment is the commencement of that state of mind recognized under the various names of conscience, the moral sense, the sentiment of obligation. The major part of every community adopt certain rules of conduct necessary for the common preservation of, or ministering to, the common well-being. They find it not merely their interest, but the very condition of their existence, to observe a certain number of maxims of self-restraint and of respect to one another's feelings on such points as person, property, and good name.

Obedience must be spontaneous on the part of the larger number, or on those whose influence preponderates in society; as regards the rest, compulsion must be brought to bear." "Compulsion must be brought to bear" to secure respect for health and life, as well as for property and good name.

VII.

Sarcastic old Rabelais makes his hero find a book in the library of a convent, entitled "The Meditations of a Holy Nun in the Perils of Childbirth." A book, entitled "The Meditations of a Quack Midwife in the Act of Killing new-born Babies," might be profitably written, if any one could suppose that an ignorant, presumptuous creature, venturing to approach the lying-in woman, at the sacred hour of maternity, with unskilled and often unclean hands, is mentally or morally capable of meditating at all. Educated midwives are a boon to the poor. Women who offer their services without knowledge—knowledge ascertained and certified to by a properly appointed public authority—should be treated as criminals. The number of "still-births" in all our mortuary records is fearful. Quack midwifery is among the obvious causes, but not the sole cause. Liberty to slaughter innocents seems to be quite as dear to the feminine as to the masculine heart. These Lucretia Borgias of the bed-side will in due time have a proper place in the history of peoples.

VIII

Whoever tries to live entirely by rule may end by not living at all. It would be a fatal mistake, however, to take encouragement from this to live an irregular life.

IX.

The house in which a man dwells is his outer garment. If the walls are damp, he is in the condition of one sitting in wet clothes. Colds, rheumatism, pneumonia, consumption, and other distempers may come from such a source. Walls built of brick from the foundation are always damp. Water is carried up from the earth by capillary attraction. A brick will absorb a pound of water. So you may have as many pounds of water in the walls as there are bricks in the house. The remedy is simple. There should be a course of slate, vitrified brick, or asphalt, a little way up from the earth, all around. Stone foundations are safer than brick, yet not altogether secure. Another thing of very great importance is connected herewith. Dry walls are pervious to air. By means of a properly shaped tube a candle may be blown out through a dry brick. As soon as cold weather comes, when the habit is to close windows and doors, and the fires are lighted, there will be an interchange of air between the outside and the inside of a house through dry walls. Thus the house will be ventilated without draughts. In fact, this is the most important factor in natural ventilation.

On the other hand, wet walls are impervious to air. No ventilation can take place in the manner described. The air, therefore, in a damp house is always close and foul. In it flourish all sorts of microscopic things belonging both to the animal and vegetable kingdoms. Even larger and visible fungi flourish in a damp house. Things become "moldy," as we say. As all organizations that live and grow must decay and die, it follows that the air of a damp house will be more or less poisoned with dead bacteria and rotting bacilli. Human life is worth a great deal more in a dry house than in a wet one. So build your habitation in a way to keep it dry.

X.

Oxygen is nature's favorite disinfectant. Combustion is rapid oxidation. The atmosphere is the great source of oxygen acting as a purifier. Foul liquids are rendered harmless by filtration through aerated earth. But it is not so much the earth that purifies as the air that permeates it. Underdrained land is very porous, and contains a large supply of air. In the air with which the pores of the earth are filled there is a superabundance of oxygen. The porous earth acts as a sieve, which breaks up the liquid filth into fine particles, bringing it into contact with the oxygen of the contained air. All organic matters are rendered harmless by oxidation. Oxygen is, indeed, the most abundant product of nature. It constitutes about one half, by weight, of the earth's crust. Sand is

more than half oxygen. It constitutes 48 per cent of limestone. Clay contains 50 per cent of it. It is 89 per cent of water, in oceans, rivers, lakes, The atmosphere contains 23 per cent of oxygen.

If, then, water contains so much larger a percentage of oxygen than air, and organic filth is purified by oxygen, why does not water purify it more rapidly than air ? For this simple reason, that oxygen is chemically combined with hydrogen to form water, while it is mechanically combined with nitrogen to form air. In the latter, oxygen is a free agent. In the former, it is combined with something else. Ordinary combustion consists in union with oxygen. Water is burnt hydrogen. Air is simply oxygen diluted with nitrogen. Hence, the free oxygen of the atmosphere unites with, or burns, putrescible matters and renders them harmless. Still water makes a "dead bree" of the same matters, instead of giving up its oxygen to burn them. Water, when violently agitated, as in turbulent streams, or lakes swept by winds, contains some admixture of air, the free oxygen of which purifies a limited amount of filth thrown into it.

And, in the air itself, ozone, which, according to Dr. De Chaumont, is an intensified oxygen with a greater number of atoms, is probably the most powerful and rapidly destructive agent of putrefying organic matters. "Ozone," he says, "oxidizes (burns, in fact) organic matter with great rapidity, much more rapidly, in fact, than ordinary oxygen. In this way it may be considered the great scavenger of the air."

XI.

All matter may exist in a solid, liquid, or gaseous state. A whole book might be written on this subject. As a rule, poisons are least dangerous in the solid form, and most dangerous in the gaseous form. Gases are invisible. Hence, we are often in the midst of unseen dangers. How few know anything about the gases of organic decay that frequently pervade the living-rooms of habitations! Those who do know about them give them no heed for the most part. Out of sight, out of mind. Some even refuse to believe what they can not see. Let such wrestle with the whirlwind, which is only an invisible gas in violent motion. Touch, and smell, and hearing help out the imagination and assist belief. Yet deadly things exist which none of the unaided senses can recognize. The spectroscope, the microscope, and chemistry reveal for us new realms. And the reasoning intellect builds for us ladders of science on which we laboriously climb to truth, as we are carried on the wings of faith to the supersensual.

XII.

The often-quoted aphorism of Franklin, "Public health is a nation's wealth," is a one-sided truth. Thrift, industry, integrity, sobriety, education, prudence, judgment, patriotism, are important factors, as well as health, in national prosperity. A healthy spendthrift can squander an inheritance quicker than

a sickly one. A lazy invalid is not so expensive as an able-bodied beef-eater. A vigorous knave can appropriate more of the earnings of honest people than one who is bed-ridden. A drunkard of physical capacity can waste more than a milksop. A muscular fool can upset more things than a feeble one. A hearty rattle-brains can always beat a puny one in begetting disasters. A robust crank is always more dangerous than one who is weakly. An athletic revolutionist can annihilate more national wealth than one who frequently seeks a hospital. Let us have things in proportion, in sanitation as elsewhere.

XIII.

In a city of considerable size, I had six acres of beautiful, planted ground. Close by the house was a well of sweet, cool, clear water. A trench, dug in the street, just twenty-three rods away, for the purpose of constructing a sewer, cut off the source, and the well dried up. Suppose somebody had sunk a privy-vault or cesspool near or over the vein of water in the earth supplying the well. In due time, persons drinking the water would have slowly sickened with a typhoid type of fever, and some of them would probably have died. If some one infected with cholera or enteric fever had used the vault or cesspool, the disease would have been conveyed through my well to those drinking its water. If the sewer had not cut off the vein, leakage from it might have caused the same disasters. A skilled sanitary inspector would

have been troubled to discover the source of the poison. A well in London, the water of which was clear, sparkling, and pleasant to the taste, was found to be scattering zymotic diseases among the people in the neighborhood using it. A government chemist demonstrated that the water was impregnated with the products of decay in surrounding cesspools and grave-yards. Yet the people protested against the official closure of the infected well. So difficult is it to convert sanitary sinners! No one should drink water from a well or spring within an inhabited area till the good time comes when the earth about human habitations shall no longer be polluted with vaults, dunghills, heaps of garbage, etc.—when all organic wastes shall be removed without allowing them to touch and defile the soil on which man lives, or infect the air of heaven which he breathes. In the mean while—and it may be a long while—if you and the dear ones of your household must use water thus exposed, boil it before drinking it. Nearly all disease-germs are killed by cooking. Never be deceived by the look and taste of water; judge it also by the surroundings.

XIV.

In the cities of China all filth is thrown into the streets. It looks bad enough. It smells bad enough. Yet Chinese cities are remarkably free from typhoid fever and other filth-diseases. Why? Simply because in China all filth is quickly removed from the streets for manure. The filth is not left long enough

to undergo putrefaction. The gas resulting from putrefaction contains the disease-generating poison. Most people suppose that fresh excrement is already in a state of decomposition. This is not so. Like a dead cat, it undergoes putrefaction more or less swiftly according to surrounding conditions of temperature, moisture, etc. Sulphureted hydrogen is like the bark of a dog that is not very terrible for its bite. The gas of putrefaction is like the bite of a dog that gives no warning bark. Besides, filth putrefying in the open air is not so dangerous as filth putrefying in close vaults, cesspools, and badly constructed sewers. A basketful of dead rats in the street are not half so offensive as one dead rat in the wall. It would be interesting to know what the Chinese think of our methods. There is a perilous journey from sanitary ignorance to sanitary science, from unsuspecting sanitary innocence to conscious sanitary virtue.

XV.

Stables, in cities or elsewhere, are a necessity. Men can not do without horses. And these faithful slaves of mankind must be housed. As a rule, a stable is a nuisance, by reason of noise and smell. A stable, however, need not be a nuisance. The fault is in the building and maintenance. The site of a stable should be thoroughly underdrained. The floors should be of concrete covered with a pavement of Bermuda asphalt, like the pavement in the streets of Washington. Plank floors are noisy. Wood absorbs the urine

of horses and becomes foul and stinking. Most stable-floors of plank leak, and the ground underneath becomes gradually saturated with liquids undergoing putrefactive decomposition. Old livery-stables, the habitations of several scores of horses, are among the worst nuisances of villages and cities. Ordinances, statutes, and the common law afford sufferers in the neighborhood means of relief, if they choose to employ a lawyer and seek their remedy. All liquids from a stable, public or private, should be conveyed to a sewer, or other proper place, with as much care as the sewage from a house. Manure should not be thrown outside on the ground. It should be put in a proper box inside, kept dry, and frequently removed to the land. Many persons assert that the smell of a stable is healthy. There are dunces who think that the smell of a sewer or a vault is not unhealthy. The gases arising from the putrefactive decomposition of the excreta of horses are poisonous, like the gases arising from the decomposition of any other animal matter. The urine of horses contains about six times as much putrescible matter as the dung, and is therefore six times more dangerous, as well as being six times more valuable for manure. Horses are very sensitive to unsanitary conditions. Men will stand an atmosphere containing one part in two hundred and fifty of sulphureted hydrogen. Half that amount will sicken a horse. Veterinary surgeons in European armies have recently saved a vast expenditure in horses by underdraining and ventilating stables. It costs but little more to make and maintain a sani-

tary and noiseless stable than it does to make and maintain one that annoys the neighborhood with foul odors and reverberating sounds. The increase of expenditure will be returned manifold by the healthier condition of the animals. Every nuisance stable should be treated without toleration. The horse is a noble animal; he knows more and suffers more than you think he does; and you should treat him, as the Arab does, with tenderness and humanity, like a gentleman.

XVI.

Dr. Buchanan, in England, and Dr. Bowditch, in the United States, simultaneously demonstrated that the wetness of soil is at least the exciting cause of phthisis. Surface accumulations of water are not only inconvenient and unsightly, but also disagreeable and unhealthy. Subsoil dampness makes the sight of any habitation incompatible with comfort and duration of life. Therefore, the first care in the preparation of the abodes of man, and, it might be added, of domestic animals, should be the drainage of the soil. Removal of water from beneath and around the house and outbuildings increases warmth, fertility, and wholesomeness. What is true in this respect of an isolated habitation, is also true of collections of habitations in the village and groups of villages constituting the city. The only known means of preventing malarial diseases is good drainage. Surface drainage does much in this way. Drainage of the soil to the depth of two or three feet, as in the agricultu-

ral regions of England, does more. Entirely effective drainage of land should be to the depth of four or five feet. Drainage of the site of a habitation should be lower than the cellar and the foundation.

XVII.

The backhouse is not a *relic* of barbarism. Wherever found, there *is* barbarism. Moses and the cat have taught mankind better than to construct and maintain such a Hindoo temple of filth. The great hole in the ground, near the habitation, to be gradually filled with the vilest human excrement, which undergoes constant putrefaction evolving poisonous gases, infecting and gradually supersaturating the surrounding earth, perhaps seeping into the water of an adjacent well, becoming the nidus of swiftly multiplying germs of infectious diseases that nature labors to eliminate by the secreting functions of intestines, kidneys, or skin, is an abomination tolerated by ignorance, apathy, and vile habit. Clean it out, remove the dangerous contents far off to the hungry land, disinfect the desecrated place, fill it with clean earth, and sin no more. You can make a wholesome vault for seventy-five cents, if you are not too lazy, stupid, and obstinate. Buy an empty kerosene-barrel at the nearest grocery. Saw it in two, in the middle, and thus make of it two tubs which will not leak. Place the two on top of the ground under the holes in the privy-seat. Keep the contents of the tubs dry with the house ashes or with dry earth gathered in the

summer. The contents of the tubs will evolve no gas, will not undergo putrefaction, will not smell to heaven or the other place, will not maintain the life of bacteria or disease germs, as long as such contents are *kept perfectly dry* by the admixture of ashes or desiccated earth. When the tubs are full, pull them out and spade the contents into the garden. In the mysterious alembic of nature the filth will be transformed into grass, fruit, or flowers, causing no nuisance. If you have no garden, send the tubs away to be emptied on the land. This will cost much less than the cleaning of a devil's magazine of pestilence called a privy-vault. The simplest and cheapest form of the earth-closet is here commended.

XVIII.

Investigators must not forget the fact that microscopic plants and animals become the causes of diseases in man only when they are parasitic. Neither must investigators forget the further fact that microscopic animals, like other animals, breed by fecundated ova; and that microscopic plants, like other plants, are propagated by fertilized seeds. Bisection, budding, transplanting, growth from layers, etc., are subordinate to the main facts, yet important. It is not sufficient, for example, to study the *Bacillus anthracis* as a plant which gives a milder form of splenic fever, which is easily destroyed by the heat of boiling water; but the spores must also be studied, which give the deadly form of the same fever, which,

as Professor Tyndall has demonstrated, can be destroyed only by about 340° of heat. The subject opens up a wide field for hypothesis and experiment. It is well known that a "black" frost entirely arrests yellow fever. A "black" frost may kill the yellow-fever plant and arrest the germination of its spores. Yet the same spores may germinate with the returning warmth of the following season and continue the disease. A frost will kill the young corn-plant. Yet seed-corn may be hung up in an atmosphere below zero all winter without losing its vital power to sprout—under proper conditions of soil, moisture, and warmth—the following summer. Wheat has grown well after remaining several thousand years in an Egyptian tomb. Heat is more likely to destroy germs than cold. Boil seed-corn, and it will not grow. It is a known fact that steam will disinfect a ship of yellow-fever. It is a known fact that freezing will not. Yet sanitary "cranks" persist in advising the destruction of yellow-fever germs in ships by cold. I predict that in due time superheated steam will be used to destroy germs of cholera, typhoid, typhus, and other zymotic diseases, not only in ships, but in other places where it can be made available.

XIX.

At a meeting of the French Horticultural Society, says Colonel Waring, there was a discussion as to the influence of plants on water containing putrefying organic matter; and evidence was adduced to show

that, while such water, left to itself, retains its putrescent character, the same water in which roots of growing plants are feeding loses entirely the *bacteria* which accompany putrescence and contains only the larger infusoriæ which are peculiar to wholesome water. It was sufficient to allow a living root to act for five days, for the water to lose all its bad smell and to become purified. It is a sound instinct of humanity that leads to the planting of trees around a spring or well. An elm or soft maple, planted over a buried vault, will in time do scavenger-work that ought to have been done more promptly at the outset. A bed of sunflower-plants will rapidly appropriate foul moisture in a neglected or abused corner of the yard or garden. The eucalyptus, above all other trees, drinks up a vast quantity of malarial water. A judicious planting of the thirsty eucalyptus has made wide regions of Italy and Algeria healthy. I cut the following from a newspaper: "Where there is surplus moisture to dispose of, as, for example, a cesspool to keep dry, a large eucalyptus will accomplish not a little, and a group of them will dispose of house-sewage. But if you have water which you do not wish to exhaust, as in a good well, it would be wise to put the eucalyptus very far away. Daniel Sweet, of Bay Island Farm, Alameda County, Cal., recently found a curious root-formation of eucalyptus in the bottom of his well, about sixteen feet below the surface. The tree to which the roots belonged stood fifty feet from the well. Two shoots pierced through the brick wall of the well, and, sending off millions of fibers, formed a dense mat that

completely covered the bottom of the well. Most of these fibers were no larger than threads, and were so woven and intertwisted as to form a mat as impenetrable and strong as though regularly woven in a loom. The mat, when first taken out of the well, was water-soaked and covered with mud, and nearly all a man could lift, but, when dry, it was nearly as soft to the touch as wool, and weighed only a few ounces. This is a good illustration of how the eucalyptus absorbs moisture, its roots going so far to find water, pushing themselves through a brick wall, and then developing enormously after the water is reached. Mr. Sweet thinks one of the causes of the drying up of wells is the insatiable thirst of these vegetable monsters." The eucalyptus flourishes well in our Southern States and in California. Plant-life of all kinds feeds on the dangerous decay of animal life. Flower-beds around habitations are wholesome as well as pleasant to the eye.

XX.

Quarantine, in the earlier sense of the term, is a relic of ignorance and of its consequent barbarism. To shut well people up a certain number of days in an infected ship is cruel, and may be murderous. Remove the sick at once to a proper hospital on shore. Let them remain there till cured. Remove those who have been exposed to an infectious disease to a proper place of detention on shore, there to remain till all danger of "coming down" with the disease is over. Then let them go. If any "come down" there, trans-

fer them to the hospital among the sick. The natural history of infectious diseases is now so well known that a properly qualified officer can manage the matter with entire safety to the public and with humanity to the suffering and the exposed. Let the ship and its cargo, as well as all personal effects, be thoroughly disinfected, without unnecessary delay. With knowledge and care such disinfecting can be made entirely safe. After which let the ship go about its business. Quarantine, in its new and proper sense, is now an exact science. Its agents must be chosen with sole reference to their capacity and honesty. With proper experts, quarantine may be made a successful art, to the great relief of commerce, while the public is protected.

XXI.

How harmless, non-parasitic growths may be transformed into poisonous and parasitic ones, has been hypothetically described, with both ingenuity and learning, by Dr. Roberts, of Manchester, England, in an address delivered to the British Medical Association, of which he was then president. "If contagia are organisms," he says, "they must possess the fundamental tendencies and attributes of all organized things. Among the most important of these attributes is the capacity for 'variation' or 'sporting.' This capacity is an essential link in the theory of evolution, and Darwin brings forth strong grounds for the belief that variation in plants and animals is

not the result of chance or caprice, but is the definite effect of definite (though often quite obscure) causes. I see no more difficulty in believing that the *Bacillus anthracis* is a sport from the *Bacillus subtilis*,* than in believing, as all botanists tell us, that the bitter almond is a sport from the sweet almond—the one a bland, innocuous fruit, and the other containing the elements of a deadly poison. Cholera suddenly breaks out in some remote districts in India, and spreads from that center over half the globe. In three or four seasons the epidemic dies away and ceases altogether from among men. A few years later it reappears and spreads again, and disappears as before. Does not this look as if the cholera virus were an occasional sport from some Indian saprophyte, which, by variation, has acquired a parasitic habit, and, having run through countless generations, either dies out or reverts again to its original type? Similarly, typhoid fever might be explained as a variation from some common saprophyte of our stagnant pools or sewers, which, under certain conditions of its own surroundings, or certain conditions within the human body, acquires a parasitic habit. Having acquired this habit, it becomes a contagious virus, which is transmitted with its new habit through a certain number of generations; but, finally, these conditions ceasing, it reverts again to its original non-parasitic type."

* The allusion is to a conclusion of Professor Cohn, that the deadly *Bacillus anthracis* is identical, in development and form, with the harmless *Bacillus subtilis*—only the rods of the latter move, while the rods of the former are motionless.

This brilliant hypothesis explains not only the origin of epidemic diseases, but also their *de novo* appearance, without continuity of contagion. At the same time it avoids the irrational doctrine of heterogeneous origin of species.

XXII.

The daily cost of milk in a city of one hundred thousand inhabitants is not less than one thousand dollars. The total cost for a year is $365,000. If the food-value of milk is diminished only ten per cent—a very low estimate—the annual loss to the consumers would be $36,500. A tenth part of this sum would provide for thorough inspection under a proper law. Will somebody tell us why proper legislation on the subject is so difficult? The pecuniary loss is the least of the resulting evils.

XXIII.

Medical and sanitary journals are filled with distressing accounts of the spread of typhoid fever, scarlatina, diphtheria, and other contagious diseases, by means of infected milk. Until stringent provisions can be made by law for the inspection of "dairies," including the families of dairymen and all who handle milk, the only safety for the people is to boil their milk before using it. The germs of disease are, as a rule, quite harmless when well cooked.

XXIV.

In the city of Milwaukee I spent a month, as Commissioner of Health, in making a careful and faithful inspection of the "dairies" from which the milk-supply came. The conditions of food of cows, cleanliness and ventilation of stables, drainage, water, surroundings, etc.; whether the animals were healthy, turned out to pasture in summer, constantly confined in winter, etc.; whether the proprietors were filthy, negligent, etc.—all the facts were written out separately for each "dairy," tabulated, and indexed. The index alone made over two hundred and fifty pages of manuscript. When all was completed, I invited citizens, through every newspaper in town, to call at the health-office and read a detailed description of the places from which they obtained milk for their households. Out of 120,000 inhabitants, the population at that time, just eleven came to see the record. Yet the apathy of Milwaukee citizens on this subject is not exceptional. Will somebody account for it in a rational way? About fifty per cent of a city's mortality is of children under five years of age. Among the causes of such premature mortality, bad milk, or milk poisoned with disease-germs, may be reckoned among the first. The poor little ones, with their pale, upturned faces, with bloodless hands folded on their motionless breasts, with their dumb lips, plead to heaven in vain; for even a voice from the dead can not arouse the living from a fatalism more appalling than that of the Mohammedans. What effect would it

have if an enlightened preacher, instead of talking at the funeral about a mysterious Providence, were to accuse the milkman point-blank of murder? The people would probably mob the preacher instead of the milkman.

XXV.

"No animal," says Professor Van Beneden, of Louvain, "at any time has attracted so much attention as that little worm which lives in flesh, rolled up; it is about the size of a millet-seed, and was found by chance in the dissecting-room of a London hospital, some forty years ago.* . . . The trichina is a nematoid worm, and not an insect, as it was at first called. Let us imagine an extremely slender pin, . . . rolled upon itself in a spiral form, so as to lodge in a cavity hollowed out in the midst of the muscles, in a space not larger than a grain of millet. . . . Professor R. Owen . . . gave them the name trichina, because they are thin as a hair; he added the specific name of spiralis on account of the manner in which they were rolled up in their cyst. Trichina spiralis is therefore the name of this animal.

"The trichinæ, which are now completely known in the minutest details of organization and manner of life, have a distinct mouth, and they have a complete digestive tube, with an orifice at each end of the body, like all worms in the form of a thread, which, for this reason, are called by naturalists nematoids, as

* It was in 1832.

opposed to cestoids (in the form of a ribbon or tape). Besides this nutritive apparatus, trichinæ, like nematoids in general, have the sexes divided into two distinct individuals, so that there are males and females, which can be easily distinguished from each other by the form and size of the body.

"Trichinæ are found in the flesh of almost all the mammals. If we eat this trichinous flesh, the worms become free in the stomach as digestion goes on, and they are developed with extreme rapidity."

With this general description by Professor Van Beneden in mind, let us follow the migration of the little viper from the flesh of a pig into the flesh of a man. A piece of raw or half-cooked pork, containing encysted trichinæ, is eaten. In the stomach the cysts are digested enough to set the worms free. It would take twenty-eight of them, placed end to end, to measure an inch in length. It would take six hundred of them, laid side by side, to measure an inch in width. After being set free, they pass from the stomach into the intestines, and uncoil themselves. Then they grow very rapidly, and develop their sexual character. When grown, it would take only from seven to nine of them, placed end to end, to measure an inch. A great number of eggs in the females are developed into embryos. Birth is given to a myriad of little trichinæ, so small that it would take from one hundred and twenty to one hundred and forty of them, placed end to end, to measure an inch. The enterprising little rascals bore their way through the intestines, and travel to every part of the body. The

tissues are irritated by the journeying of the animals, which tunnel as they go. Besides, they grow rapidly. And when they have selected and pre-empted a "homestead," they coil themselves up, and about each one separately is built a house or cyst. They have now reached the same size the parents had when they first entered the human stomach. Here they wait—years, it may be—for some other animal to devour the flesh in which they are buried, when they, too, may be set free and enjoy a brief honeymoon, like their progenitors.

The disease caused by the migration of the little trichinæ from the intestines to the muscular parts of the body, and by their growth, is dreadful, and very often fatal. It resembles typhoid fever, with swelling and intense pain of the muscles. Death usually takes place in the fourth week. The worms have then done traveling, are developed and encysted. If the patients survive that period, they may live on for years, but they are pretty densely populated with worms. In a pound of human flesh, Leuckart found 700,000 trichinæ. In a cubic inch, 80,000 have been counted. It has been estimated that as many as 250,000,000 may exist in a single pig.

Trichinæ are very tenacious of life. Death of the animal which they inhabit does not destroy them. Complete decomposition of meat filled with them does not extinguish the vital spark of their existence. Freezing does them no harm. According to Küchenmeister, ordinary smoking of meat does not disturb trichinæ. The corpse of a pig infected with them may be entombed in a pork-barrel, with plenty of

salt, and the worms will survive. The carcass of an animal peopled with trichinæ may be "imprisoned in thick-ribbed ice," may "lie in cold obstruction, and rot," without disturbing its encysted denizens. There is something sublime, even poetic, in the long, dumb expectancy of these little creatures, in their solitary and silent hope of a resurrection in the blood-warm stomach of some unknown animal, there to realize the Mohammedan glories of a new and fruitful life.

The only convenient thing that will kill them is an orthodox dose of fire. Man usually receives trichinæ from pork. According to Fiedler, a temperature of 155° Fahr. will destroy free trichinæ; but the encapsuled trichinæ require greater heat. I should advise giving them a wholesome Calvinistic climate of about 300°. Nothing but the thorough cooking of pork can make it safe food for man. If it cuts red and rare, like beef, on the table, it should be avoided with religious determination.

There have been grave epidemics of trichinosis in Germany and the United States. The disease has probably been more frequent than hitherto observed. Swine fed on garbage, dead rats, and offal are much more likely to be infected than those fed on the wholesome products of farms.

XXVI.

I cut the following from the Detroit "Medical Age," whose bright editor states the fact very clear-

ly: "The Ill-doings of Flies.—Dr. B. Grassi, of Rovellasca, reports, in a recent number of the 'Gazetta degli Ospitali,' some investigations he has been making on the above subject. He has convinced himself that the common house-fly is a dreadful enemy of the human race, as of all living things in general. Whenever any infectious product is present—for instance, the sputa of phthisical patients, or dejecta from the intestinal tract—swarms of flies are to be seen, which soil themselves with the offensive material, and then crawl about over our food. The writer placed a plate containing a large mass of the ova of a human parasite (trichocephalus) upon a table in his laboratory, which was situated at the distance of about thirty feet from the kitchen. Sheets of white paper were placed in various parts of the kitchen, and in the course of a few hours the dejecta of flies were observable on the paper. Upon examination of these with a microscope, they were found to contain some of the ova of the parasite. Dr. Grassi then killed some of the flies, and found an enormous mass of fæces containing more of the ova. On another occasion he minced some segments of tape-worm that had been preserved in spirit, and put them into water, so that a mass of ova were suspended in it. In half an hour he succeeded in finding the ova of the parasite in the abdominal contents of the flies, and also in the spontaneously deposited dejecta. In like manner it could be proved that flies, that had alighted on moldy cream, harbored the spores of *oïdium lactis*. It is useless to comfort one's self with the thought

that these germs die in the intestines of the flies. Even if the intestinal juice do act upon them, and it is not proved that it does in the case of bacteria, some would almost certainly escape destruction. In any case, moreover, the legs and proboscis would still serve as carriers of the infection. He proposes that attempts shall be made to introduce the same disease among them in the spring-time that already causes such devastation in the autumn."

It is very important to cover all articles of food with fine wire netting in "fly-time." During the hot season, when particles of organic matter are undergoing rapid putrefaction, flies do a great deal of useful scavenger-work; but they are not needed in a clean house. Shut them out with window-screens, for the sake of sanitary safety as well as comfort.

XXVII.

Free love, as between you and your neighbor's wife, may be very agreeable to you; but, as between your neighbor and your wife, is sure to be disagreeable to you. So, a cesspool on the back end of your lot, under your neighbor's dining-room window, may be convenient for you; but a cesspool on the back end of your neighbor's lot, under your dining-room window, is not entirely satisfactory to you.

XXVIII.

One gallon of water, let through a soil-pipe with a rush, in a mass, as it were in a small flood, will flush

better and cleanse more than a whole barrel of water flowing in a small, continuous stream. Look for this quality always in selecting a water-closet. The pan-closet should never be used. It is nearly as disagreeable and quite as dangerous as a chamber-vessel constantly standing half-full in the same space.

XXIX

The best way to avoid sewer-gas is to make none. Nature gets rid of organic matter by letting loose in it myriads of bacteria, or by setting up in it a growth of countless invisible plants, which transform it and utilize it without loss. Nature, while seemingly prodigal, is infinitesimally economic. During this process of transformation, gas is evolved which is deleterious to human life. This is exactly sewer-gas, whether the gas is made in a sewer, house-drain, vault, cess-pool, or other place!* Whether the poison is a septic element in the gas or a living thing is not a settled question. Most scientists regard the poison as consist-

* A distinction is frequently made between sewer-gas and malaria. The gas produced by the decomposition of vegetable matter may be called malaria; that produced by the decomposition of animal matter may be called sewer-gas. When the matter is mixed, vegetable and animal, the gaseous product of its decomposition is mixed. As the vegetable and animal kingdoms have an indefinite boundary, it would be difficult to keep up a distinction in a practical discussion. As people may sicken or die through the instrumentality of malaria as well as of sewer-gas, the same pains should be taken and the same means employed to dispose of organic matter of vegetable as of animal origin.

ing of microscopic plants or animals, or their minute ova and spores, floating in the gas, conveyed by water, food, or air, to the human body, there to germinate, grow, multiply, causing, under favoring conditions, diseases. Some of these germs, once created in the laboratory of Nature, continue their existence according to the laws governing the origin and development of species. When these germs, so-called, become the causes of disease, they constantly recur to their source. In other words, they have their natural habitat according to their origin. For example, the fungus of typhoid, or the bacillus of cholera, may have had its origin in the putrefactive decomposition of the excreta of the sickly intestinal tract, as a poisonous "variation" of an innocent fungus, or bacillus, and finds, by "shadowy recollections," by life-instinct, its home, its habitat, its primal source, in the same tract, through drinking-water or food, multiplying the disease from generation to generation. The germ of typhus or scarlatina may have had its origin in the putrefaction of the exhalation of the lungs or skin, and may continue its life in a similar way. Hypothesis and conjecture, however, are useless, and I hasten to return to the realm of the practical.

Nature attacks dead organic matter wherever she finds it. If it is thrown out at the back door, in kitchen-slops, she attacks it there, and there generates from it a more or less dangerous poison. If it is deposited in a vault, cesspool, or sewer, Nature takes it where she finds it. Nature makes no haste and takes no rest. Some hours intervene before putrefaction

gets under way. It lasts as long as there is any unconsumed matter left, "growing by what it feeds on." If new matter is perpetually added, putrefaction never ends. The amount of matter furnished by our habitations, stables, and factories is enormous. One thousand persons, as the population averages, produce over one ton of excreta, from intestines and kidneys, every twenty-four hours. For a city of one hundred thousand inhabitants, the daily amount is over one hundred tons. About forty thousand tons annually! That does not include the putrescible excretion of the skin, which defiles a vast amount of wash-water. Kitchen-slops and garbage constitute an important factor. Add, also, the excreta of animals, in stables, cow-barns, hog-pens, henneries, kennels, etc. The refuse of slaughter-houses and various manufacturing places must not be overlooked. The organic refuse of inhabited places is about one ton per capita per annum.

What should be done with all this perilous putrescible stuff? It would take much space to tell what *is* done with it, in isolated country houses, in villages, in cities. It is easier and better to teach what ought to be done with it than to denounce existing methods.

All solid organic refuse should be carted away from inhabited places before putrefactive decomposition begins. Garbage, manure, offal, street "cleanings," etc., can not safely be disposed of in any other way. What utilization should be made of such material is an economic question that need not be discussed here. Only it must not be forgotten that the

sanitary question is paramount, as health and life are more important, even from a money point of view, than the value of fertilizers.

Liquid waste, water carrying in solution or suspension putrescible organic matter, is most easily disposed of by means of a sewerage system. The sewage of a house, village, or city is exactly the water used and fouled with the refuse of life. This sewage should be kept separate, and constantly removed by pipes exclusively used for that purpose. No rain-water or ground-water should be mixed with it. The sewerage system should be constructed of the best vitrified or glass pipes, and of no other material. A brick sewer will inevitably absorb sewage, and produce sewer-gas. Each brick will absorb about one pound of this liquid, which becomes diabolical as soon as it has time to begin putrefactive decomposition. As the quantity of the sewage is measured by the quantity of the water-supply, the pipes in the sewer system need not be large, not very much larger than the water-pipes. And they may be so distributed to the outfall that large mains will nowhere be needed. These vitrified or glass pipes should be laid with the greatest engineering care, so as to secure tight joints and a constant flow. All "dead ends" should be well washed out at least twice daily by means of automatic flush-tanks. Opposite to every lot an acute-angled connection should be made, from which a branch of the same material should be run to a point near, but not under, the wall of the building from which sewage is to be conveyed. At that point tight connection

should be made with the cast-iron soil-pipe of the building, which soil-pipe should be run up through the building, full caliber, and open at the top above the roof. The joints of the iron soil-pipe should be calked, gas and water tight, with lead. The pipe itself, before use, should be tested for defects. From the open top, above the roof, all the way to the sewer-pipe in the street, there should be no trap. The whole system will then be ventilated high up in the air over the whole town. Into the soil-pipe openings must be made for the waste-pipes from the kitchen-sink, stationary wash-basins, bath-tubs, and water-closets. These waste-pipes must be trapped in the best manner, and the traps must be ventilated to prevent siphoning. Roof-water, surface-water, water from the under-drainage of the site of the building, water from the overflow of cisterns, and water from the melting of ice in refrigerators, must not be conducted into the soil-pipe, or into the sewer system. A separate drainage system must be constructed for the removal of all storm-water and other water uncontaminated with organic matter.

The outfall of the sewerage system should receive especial attention. The sewage of a city will contaminate a large body of water if emptied into it. A great and rapidly flowing river may safely receive the sewage of a town, but in most places it must be removed, by pumping or otherwise, to a sufficient tract of prepared land, to be disposed of by irrigation or intermittent downward filtration. Sewage thus kept by itself is manageable, because constant in

quantity, and may perhaps be made profitable for fertilization. When mixed with ever-varying and sometimes vast quantities of storm-water, it is difficult, costly, and never profitable, to dispose of it in that way.

If the plan here described is followed, no sewer-gas will be created, within the area of inhabited places. No sanitary measure is of equal value in conserving the productive energy of the people.

XXX.

The prevalent practice of removing sewage by means of the water-drainage system of inhabited places is open to many and very serious objections:

Ditches, gutters, tiles, and porous brick conduits for removing surface and subsoil water are comparatively cheap. It adds immensely to the cost to transform water-drains into sewers, so as to make them at all fit to convey liquid wastes. The combined expense of a separate drainage system and an independent sewer system is less than the expense of a single system that can not be so constructed as to perform well the double service of removing water from the soil and liquid refuse from habitations.

In most places it is not difficult to find a proper outfall for the water of a drainage system. As soon as sewage is mixed with the flow of drains, the whole mass is contaminated, and the trouble and cost of securing a safe outfall are, as a rule, greatly increased. The necessity of pumping vast quantities of rain-

water and subsoil-water, mingled with the liquid refuse of houses and factories in the same system in the new sewerage-works of Berlin and Dantzic, increases the running expenses to an extent threatening failure.

The sewage proper of a city is nearly a constant quantity. It is measured by the amount of water daily used in houses and factories. Consequently, the engineer, in constructing a system for the removal of sewage proper, can adapt it to a constant flow, and make it self-cleansing. On the contrary, rainfall is an immensely variable quantity. A drainage system for its removal must be of maximum size. When sewage, therefore, is turned into the drainage system, a slow flow will be inevitable much of the time, resulting in putrefaction and the generation of sewer-gas, the presence of which within the area of inhabited places dangerously violates the most vital law of sanitation.

In the drainage system all conduits are purposely made to let water in. The object is to convey water away from the soil. But a porous drain will strain sewage through into the earth, and gradually pollute it. Consequently, a conduit for the conveyance of sewage must be tight—hence the absolute incompatibility of the two ends sought in the same structure. A good sewer is a bad drain. A good drain is a dangerous sewer. Attempts are constantly renewed to attain the double quality of perviousness from without and imperviousness from within, with unceasing and inevitable failure. Sanitarians who are quacks

in engineering have tried it in vain. Engineers who are quacks in sanitation have tried it equally in vain. Quacks in both engineering and sanitation, well represented in city boards of public works, obstinately keep up their search for the unattainable, like the seekers of the philosopher's stone and the inventors of perpetual motion.

Water stored in cisterns is almost invariably poisoned by the way of overflow-pipes which discharge into the sewer systems of inhabited places and return the dangerous gas. And the drain-pipes from cellars and basements generally furnish avenues through which this invisible foe of human life in cities finds easy ingress to habitations. A separate drainage system affords an easy means of guarding against peril from such a source. Sanitary inspectors are often astounded by finding a tube from an ice-box, in which choice and delicate food, like meats and milk, is kept, running directly into a sewer-pipe. The combined sanitary and engineering quack will tell you, with pitiful ignorance, that the deadly sewer-gas is kept out by means of a little water-trap through which a baby could blow with a straw. A separate system, used exclusively for sewage, is the only certain safety against such danger.

With the clumsy, costly, perilous, combined system in general use for removing water and sewage together, the earth of towns gradually becomes infected with organic matter in a state of putrescence. Hence the water of springs and wells at length becomes polluted and unfit for use. With a separate,

properly constructed and properly managed system of impervious pipes for the removal of all sewage, and with other sound sanitary regulations for the care and removal of solid organic refuse, there is no reason why the spring-water and well-water of towns should not remain clean and wholesome. Besides, when the earth of inhabited places is kept so clean as to preserve the purity of the water, no exhalations will arise from it deleterious to health and dangerous to life.

XXXI.

It has been objected, in relation to separate systems for drainage and the removal of sewage, that droppings of horses and other animals in the streets, steeping in the rainfall, will be a source of pollution to surface-water, rendering it putrescible, and consequently capable of generating sewer-gas. The simple and effective remedy is cleaning the streets frequently and well. Most cities would thereby be greatly improved, both in appearance and salubrity.

It has also been objected that, in quarters where the vitrified pipe-sewer system for the removal of sewage does not extend, there the inhabitants must throw the liquid wastes of household life upon the ground. No such necessity exists. Even an isolated habitation in the country should have its sewer-pipes, entirely separate from the drainage system, to convey kitchen slops, wash-water, and other dangerous liquids to a place of safety. The reason why typhoid fever, diphtheria, and some other filth-diseases are so prevalent

in country districts is, that privy-vaults so frequently seep into wells, and the animal excreta of pig-pens and stables are left to poison the earth and the air. The ground about kitchens, supersaturated with slops, very often becomes putrescent in the summer warmth, breeding disease which superstitious ignorance attributes to Heaven. A householder may dispense with his parlor and its adornments, if necessary, but he can not afford to invite upon himself and family disease and death by neglecting to provide the means of keeping the site of his habitation dry and clean. *Laborare est orare*—"To labor is to pray"—said the wise old monk, and the most effective prayer for health is to supply every needed hygienic device for the sacred home of the family.

It is further objected that most of our cities are already sewered for the double purpose of removing storm-water and sewage through the same conduits, and that we can not afford to do the costly work over again. It is one of the fates of progress that faulty methods must be followed by reconstruction. No works last forever; and when we build anew we can do it better. In the mean time, the faulty old sewers with their dangerous debouchements into the nearest streams, lakes, or ocean-harbors, can be washed out, disinfected, and used exclusively for water-drainage, while a supplementary system, with safe outfall, for the removal of sewage alone, is constructed with proper engineering skill under the direction of sanitary science. The cost of such a supplementary system is not more than one fourth of that of the prevailing system.

XXXII.

A great principle to be kept in view is the removal of sewage (not sewage diluted with vast quantities of surface and subsoil water) without pollution of the soil, without putrefaction, and consequently without generation of sewer-gas on the journey.

The entire excreta of human beings may be admitted to the sewerage system for water-carriage. The privy-vault should not be tolerated in any civilized neighborhood. Where there is no sewer system, some form of earth-closet ought to be used, and the contents frequently removed. The liquid portion of the excreta of horses and other domestic animals should be constantly removed by the sewer system. The solid portion should not be thrown upon the ground and bleached by rain, but be kept under cover, dry, and be frequently carted away. In fact, no organic matter should be thrown on the ground, nor deposited in the ground near human habitations. The soil where man dwells is sacred, and it is sanitary sacrilege to pollute it. He who fouls the air that he breathes himself, or the water that he drinks, or the food that he eats, is a barbarian who might learn wisdom from the cat or decency from the swine. He who fouls the air that another must breathe, or the food that another must eat, or the water that another must drink, is a criminal to be classed with those who maim and kill.

There are more reasons for care in the removal of organic wastes from inhabited places than appear on the surface. The chemistry and hygiene of putrefac-

tion are complex, involving many practical considerations. Wherever there is a collection of putrefying organic matter, whether on the ground, in the ground, within a faulty sewer, or under a habitation, there is a tireless foe to health and life. Not only are putrescent collections of garbage, decaying vegetables, manure, offal, and human excreta harmful in themselves, by reason of exhalations poisoning the air and of leaching liquids polluting the earth; they are also depositories and multipliers of disease-germs. Such collections may not produce infectious diseases *de novo*, but they lessen the vitality of people living in the neighborhood, and thereby lessen the power of resisting epidemics. It is a well-known pathological fact that Nature struggles to eliminate disease by excretory processes. Accumulations of filth containing excreta may therefore harbor seeds of various communicable maladies. Sewer-gas, while it may not beget scarlatina, diphtheria, small-pox, and other contagious diseases, easily becomes the vehicle of conveying them, through obscure and intricate channels. Nor is this all. It is well known that a dung-heap will take cholera, hold it for an indefinite period, and convey it to human beings; that is, cholera dejecta thrown upon a dung-heap will plant in it the germs of the disease, there to take root and multiply, and may communicate themselves to man under favoring circumstances. A vault will take typhoid fever, have it badly for a long time, and communicate the disease to human beings. It is probable that a heap of putrescent garbage may catch diphtheria in the same

way, multiply its germs, and communicate them to unsuspecting children. There is little doubt that every seething mass of organic matter is affected with yellow fever in the midst of an epidemic of that disease. It is believed by many experienced physicians that yellow fever is not communicated from person to person, but is always caught from surrounding objects.

So great is the influence of filth in these various ways that no epidemic can make any serious headway in the midst of cleanliness. One frequented vault, down with typhoid fever, is more dangerous than a house full of patients. A big trunk, full of dirty clothes, sick with yellow fever, is more to be shunned than a small hospital full of human victims of the disease. A village dung-hill, planted with cholera, is more perilous than a dozen cholera-corpses. A foul sewer, swarming with scarlatina-germs, may be as dangerous to a neighborhood as an infected schoolhouse.

XXXIII.

Whatever engineering device is employed for draining the soil and removing rainfall should be used exclusively for the conveyance of water uncontaminated with putrescible organic matter. Such water may then be safely discharged into any convenient natural reservoir, or adjacent stream, where economy and security from flood may dictate. For removing storm-water, surface-water, and subsoil-water from the isolated habitation, neatly constructed ditches, agricultural tiles

properly laid, and occasionally deep drains of porous brick, will be sufficient. In villages, well-paved gutters, with more frequent and larger deep drains of porous brick, will be needed. In cities, brick mains, adapted in size to the areas from which the water is to be removed, must be added. A suitable size for the site of an isolated habitation, with its out-buildings, in the country, may be regarded as about three hundred feet square. The annual rainfall on that area, at the fair estimate of thirty-six inches, would amount to 270,000 cubic feet. The annual rainfall on a square mile, the average size of a village, would be nearly 84,000,000 cubic feet. On ten square miles, the area of a considerable city, the annual rainfall would be more than 836,000,000 cubic feet. On a city of ten square miles more than 20,000,000 cubic feet of water may be precipitated from the clouds in a single hour. These figures show that the drainage system of inhabited places should be adequate, as well as adapted to the desired end. Details belong, more especially, to the engineer, but he should know exactly what he is required to accomplish; his art only furnishes the means to an end pointed out by sanitary science.

XXXIV.

Long before sanitary science had taken the form of public hygiene, Dr. Benjamin Rush, the sharpest medical observer and the profoundest medical thinker produced by America, came to the conclusion that the means of preventing pestilential fevers "are as much

under the power of human reason and industry as preventing the evils of lightning and common fire. I am so satisfied of this opinion that I look for a time when our courts of law shall punish cities and villages for permitting any of the sources of bilious and malignant fevers to exist within their jurisdiction."

XXXV.

Security from dampness and stagnant water is not only security from malarial fevers, but also, in a great measure, from consumption, scrofula, rheumatism, and various other diseases. Complete aëration of the soil, to the depth of five or six feet, by efficient under-drainage, enables the earth to oxidize, and thus disinfect a vast amount of polluting matter thrown upon it, increases its temperature, and removes from it the poisons that cause ague and bilious fever, that either produce or intensify scrofula, tuberculosis, catarrh, bronchitis, and pneumonia; that aid to spread and render more fatal small-pox, scarlatina, diphtheria, and other contagious diseases; that gather to our cemeteries a more abundant annual harvest of the old, the young, and the feeble. "I feel assured," says Mr. Denton, "that as certainly as we of this generation are now engaged in removing from our rivers the polluting matters which the authorities of the last generation obliged our fathers to discharge into them, so will those who come after us lament with shame, and do their best to repair, the disregard paid by our present authorities to the drying of the

sites of habitations as one of the first considerations for the preservation of human life."

XXXVI.

Municipal corporations, like individuals, are liable for damages caused by maintaining nuisances (Donahue *vs.* New York, 4 Daly, 65 ; Harper *vs.* Milwaukee, 30 Wis., 365 ; Brower *vs.* Mayor of New York, 3 Barb., 254 ; Dorman *vs.* Jacksonville, 13 Fla., 538). A municipal corporation is liable in damages for discharging its sewers on private property (O'Brien *vs.* St. Paul, 18 Minn., 176). A municipal corporation may prevent and remove a nuisance, but a city government has no authority to sanction or license a nuisance (Adm'r of Chambers *vs.* Ohio Life and Trust Ins. Co., 1 Disney, 327 ; Ryan *vs.* Capes, 11 Rich., S. C., 1217 ; Pfau *vs.* Reynolds, 53 Ill., 212 ; Columbus *vs.* Jacques, 30 Ga., 506 ; Com. *vs.* Rush, 14 Pa. St., 186). Still less has an individual member of a municipal corporation authority to sanction a nuisance. Any individual, especially injured, has a right of action for damages against a municipal corporation for maintaining a public nuisance (Doolittle *vs.* Supervisors, 18 N. Y., 155 ; Thayer *vs.* Boston, 19 Pick., 291 ; Hunt *vs.* Mayor of Albany, 9 Wend., 751 ; St. John *vs.* the Mayor, 3 Bosw, N. Y., 483 ; People *vs.* Albany, 11 Wend., 539). The law on this point is settled, and there is no need of quoting more authorities.

Besides, a corporation is liable to criminal indict-

ment if it does not make reasonable haste to abate a nuisance. "No reason appears," says Bishop ("Criminal Law," § 418), "why a corporation, having by law power to act, should not have also by law the power to intend to act; and mere intentional wrong acting is all which is necessary in a class of criminal cases" (The State *vs.* Barksdale, 5 Humph., 154; The State *vs.* Mayor and Aldermen of Murfreesboro, 11 Humph., 217; Rex *vs.* Hendon, 4 B. and Ad., 628). "When the law," again says Bishop, "casts upon any corporation an obligation of such a nature that the neglect of it would be indictable in an individual, the corporation neglecting it may be indicted" (People *vs.* Albany, 11 Wend., 539; Lyme Regis *vs.* Henley, 3 B. Ad., 77, 92, 93). It is a legal principle universally acknowledged that corporations are indictable for nonfeasance. In cases where municipal corporations are not indictable for misfeasance, for the reason that they "have no souls," and are therefore incapable of criminal intent, yet the individuals constituting their government can not plead such inability, and are, therefore, liable to criminal indictment.

XXXVII.

The doctrine of a contagium vivum has many able opponents, like Dr. B. W. Richardson. Others, like Dr. Burdon-Sanderson, take a middle ground, and maintain that living contagia are "molecular aggregates," ultra-microscopical, "of which all we can say is that they occupy the border-land between the liv-

ing and the non-living things." Professor Tyndall responds that, "between the microscopic limits and the true molecular limits, there is room for infinite permutations and combinations," and that "a particle, whether great or small, which, when sown, produces a plant, is proved thereby to be the germ of that plant." The conflict is between the ground kernel of wheat and the whole kernel, between the broken egg and the egg entire. On the one hand, it is maintained that different kinds of septic matter, acting as diffusive poisons or ferments, produce the various diseases that flesh is heir to. On the other hand, it is maintained that every disease has its origin in a vital germ that multiplies itself indefinitely in the fertile soil of the human body. The weight of scientific opinion is now in favor of the latter theory. But, practically, it makes no difference which theory is correct. Mankind are just as anxious to escape being poisoned by a living thing as by a dead thing. It is just as hard to see a friend die with splenic fever, the cause of which is demonstrably known, as with enteric fever, the cause of which is unknown. Fortunately, the sanitarian is not obliged to wait for a solution of the great and interesting problem; he has to use the same means of preventing disease, whether disease is caused by living germs or dead ferments.

XXXVIII.

The slaughtering of animals should never be tolerated in large cities. The driving of animals through

the streets is itself a nuisance. The pens, in the rear of butchers' shops, where cattle, pigs, sheep, and calves are kept till their proprietors are ready to kill them, are frequently noisy, and always more or less offensive to the sense of smell. Not unfrequently the slaughtering is done in view of upper windows from which it is witnessed by women and children. The cry of animals, destined to the shambles, is unpleasant to the ear and distressing to the imagination. It is difficult to remove, especially in summer, the blood and offal of slaughtered animals without leaving an odor that is at once offensive and deleterious. When the weather is hot, the refuse of butchering-places is sure to taint the air before the expiration of the prescribed twenty-four hours, within which the law generally requires it to be removed. Sometimes it is hidden in a shed or dark alley, till the stench of it drives the neighbors to the health-office for protection or redress. And the vile carrion must be drawn along the streets, either by night or in the day-time. Besides, the thrifty butcher tries out the scraps for tallow or grease, giving the unfortunate neighborhood the sickening benefit of rendering in open kettles. The spilled blood and filth are at best washed into the public sewers, adding to the organic matter that undergoes putrefactive decay and generates noxious gases. Sometimes blood and liquid are allowed to run through defective floors or directly on to the ground, where they slowly accumulate and poison the earth. Now and then, if avarice, ignorance, and apathy are uncontrolled, an adjoining hog-pen, with its unclean, offal-

fed swine, increases the nuisance. When the proprietor does his best to keep his place in a neat and wholesome condition, the very nature of the business stamps it as an "offensive trade."

A meat-market need not be more offensive or unwholesome than a grocery. It is the slaughtering part of the place that creates a nuisance. The sight of good, clean butcher's meat is far from being repulsive. The slaughtering should be done outside of a city, and the sides of beef, carcasses of sheep, lambs, swine, calves, etc., should be brought by dealers to their markets, where the people can be served with exactly the same convenience as at present.

Butchers would find it more economic to combine their interests, so far as slaughtering is concerned, and provide for themselves a place in common beyond the confines of a town. Co-operation and aggregated capital would secure conveniences which few individuals can command. Modern appliances and improved machinery might then be secured. All the profits of extracting glue from the feet, of manufacturing fertilizers from blood and offal, of rendering grease from refuse parts, of utilizing hoofs and horns, of preparing tripe and souse, of making sausages for distant markets, of curing bacon and drying beef away from the dust and gases of a crowded city, of salting hides, etc., might then accrue to the ownership of the great slaughtering-place, or abattoir. The cost of bringing the meat to the markets would be less than the cost of driving animals, by squads, to inclosures where, too often, they are barbarously slain by unskilled hands

and avenge their wrongs upon an apathetic community by contributing to the causes of disease and death. The great "stink-factories" in the neighborhood of cities would then be closed for want of material on which to feed.

Not only would butchers find the plan economic, but real estate in the vicinity of every place where slaughtering is done in towns would be enhanced in value. It is, indeed, necessary to supply the people with meat, but the supply should not be at the cost of discomfort to many and the depreciated value of homesteads. The supply can be cheaper without nuisance than with it.

XXXIX.

In a city of one hundred thousand inhabitants there are about twenty thousand males of the dram-drinking age. If each of these were to spend five cents a day for a glass of beer, the expenditure would be $365,000 a year. If each spent ten cents daily for a drink of whisky, the yearly expenditure would be $730,000. If half took beer and half whisky, the amount spent would be $547,500 per annum. Some spend nothing in this way. Others drink a good deal more than a daily glass of beer or whisky. The sum spent in a city of one hundred thousand inhabitants in dram-drinking is more than $547,500 each year. Call it that. This sum is the interest at five per cent on $10,950,000. Such an expenditure would build and run all the schools and churches in the city. And the whole account is not thereby settled. Most dram-

drinking places are nurseries of pauperism and crime, for the care of which the citizens must be taxed. Above all, dram-drinking is a bankrupt debtor to health. The late Dr. Parkes, a great authority in hygiene, speaking from ample knowledge and without any temperance prejudices, says :

"It does not appear to me possible at present to condemn alcohol altogether as an article of diet in health, or to prove that it is invariably hurtful, as some have attempted to do. It produces effects which are often useful in disease, and sometimes desirable in health ; but in health it is certainly not a necessity, and many persons are much better without it. As now used by mankind, it is infinitely more powerful for evil than for good ; and, though it can hardly be imagined that its dietetic use will cease in our time, yet a clearer view of its effects must surely lead to a lessening of the excessive use which now prevails. As a matter of public health, it is most important that the medical profession should throw its great influence into the scale of moderation ; should explain the limit of the useful power, and show how easily the line is passed which carries us from the region of safety into danger, when alcohol is taken as a common article of food."

Thomas Carlyle, speaking of the laboring-classes in the city of Glasgow, thus describes the source of their greatest danger :

"The sum of their wretchedness, merited or unmerited, welters, huge, dark, and baleful, like a Dantean hell, visible there in the statistics of gin—gin, justly named the most authentic incarnation of the

Infernal Principle in our times, too indisputably an incarnation; gin, the black throat into which wretchedness of every sort, communicating itself by calling on Delirium to help it, whirls down; abdication of the power to think, or resolve, as too painful now on the part of men whose lot, of all others, would require thought and resolution; liquid madness sold at tenpence the quartern, all the products of which are and must be, like its origin, mad, miserable, ruinous, and that only."

Carlyle again touches the very quick of the question of "personal liberty":

"No man oppresses thee, O free and independent franchiser; but does not this stupid pewter-pot oppress thee? No son of Adam can bid thee come and go; but this absurd pot of heavy-wet, this can and does! Thou art the thrall, not of Cedric the Saxon, but of thine own brutal appetites and this scoured dish of liquor; and thou pratest of thy liberty? Thou entire blockhead!"

The time is coming when any community will be ashamed to tolerate a place for public dram-drinking. The economic and sanitary gain will be immense. In this respect, also, Christian nations need to improve on the lesson taught by Mohammedans.

XL.

I once spent an entire autumn in the city of Geneva, Switzerland, in charge of an invalid patient. The climate, at that season of the year, was cold, raw,

disagreeable. My heart was hungering in vain for Italy, "the land where the orange and the citron bloom." In order to tame my restless spirit, I read the "Institutes" of John Calvin and delved in the old cathedral archives, in order to glean any curious information about the period when the grim theological fatalist flourished. I found, among other things, that in his day Geneva had a visitation of the plague. A pest-house was built on the left bank of the Rhône, a few miles below the city. Thither were taken the victims of the disease. To care for the sick, nurses were hired, whose pay consisted of whatever effects—clothing, jewelry, or money—were left by those dying of the deadly malady. When the plague began to abate, the nurses stole into the city by night and stealthily daubed the door-knobs with the infectious matter in order to obtain a new harvest of victims and increase their plunder!

Now, the aforesaid greedy nurses may be regarded as saints in comparison with the hell-brood of our times who address themselves, through newspaper advertisements, to the victims of "early indiscretions," of "seminal weakness," and of other ills that debauched human flesh is heir to. Such advertisements are even found in the religious papers. Medical journals are not so depraved. Every male, from the dawn of puberty, needs proper instruction in the mysteries of life. Why generation after generation should be weakened by being left to the phallic teaching of chance and ungoverned instinct is one of the unaccountable things of our pretentious civilization. The family physician

is not always a wise instructor, and his advice is seldom sought. Fathers are not qualified to teach their sons, and avoid the subject. The victims of nervous diseases are multiplied, and we supplement the results of ignorance and vice with vast expenditures for asylums and hospitals. Medical hyenas explore the dark ways of society and fatten on the spoils of those dying of terror, if not of disease.

Is there no remedy? There are two remedies: sound knowledge; an educated will. Get the best of all books on the subject, by William Acton, entitled "The Functions and Disorders of the Reproductive Organs, in Childhood, Youth, Adult Age, and Advanced Life; considered in their Physiological, Social, and Moral Relations." It costs two dollars. There is no copyright protection for its publication in this country. It ought to be printed by the million, and sold as cheap as the New Testament. I have known wise mothers to buy it for their sons. Physicians might prescribe it, not unfrequently, for their male patients, old as well as young. It is invaluable for teachers to use among their pupils. It should be given out, with the admonitions of the gospel, from the confessional. Public hygiene must not be contented till it manfully, wisely, delicately occupies this terrible field.

XLI.

In a Western city a young girl of German parentage, fourteen years of age, bright, beautiful, admired by her teachers, worshiped by father and mother, left

school one afternoon without permission, was seen on the streets wearing a pallid, anxious, distracted look, and disappeared. The whole city searched for her in vain. The entire country was informed of her disappearance by the newspapers. Imaginary clews were followed from end to end of the land. Large rewards were offered for information concerning her. Detectives hunted for her in the highways and by-ways of cities. No ray of light penetrated the darkness of her parents' melancholy hearts. Impenetrable mystery brooded over her untimely fate.

Some months afterward, when all search had been abandoned, the young girl's remains floated to the surface of a foul river in the city. It was a consolation to her stricken family to lay her body away in the grave, to rest in peace forever. Still the distressing problem of her death was not solved.

It is painful to rend the veil covering this sad case, but the rending of it will reveal a lesson of priceless value to the living, and at the same time the lesson will vindicate and sanctify the memory of the beautiful dead. A few fortuitous hints, meaningless to non-professional people, significant to physicians, and a few wise mothers, afforded by her teachers and schoolmates, enable us to draw the dim outlines of a shadowy yet terribly tragic picture of real life.

To all girls, sooner or later, comes the holy dawn of womanhood. It finds most, nearly all, ignorant, bewildered, alarmed. In the amazing unwisdom of our schools, they have been taught to conjugate irregular verbs and to find the rivers of heathen

Africa, but have not been taught to know the course of the blood in their own bodies and to understand the natural functions of heart, lungs, brain, and other vital organs. The aurora of feminine life caught our poor girl untaught. The very nobility, sensitiveness, and pudor of her nature, with the nervous and mental disturbance incident to the period, undoubtedly led her to imagine, in her ignorance, that some awful and shameful calamity had overtaken her, of which she *could* speak to no one, not even to her mother or beloved lady teacher. It doubtless seemed to her bewildered mind that the only thing she could do to conceal her unspeakable and imaginary disgrace, to get rid of her loathed self, was to disappear unobserved and alone beneath the silent water of the inky river. The fate of Iphigenia, surrounded by her kingly father and the heroes of Greece, sacrificed in her innocence for a great public cause, was not half so tragic. In fact, the genius of tragedy, during all the ages, has never conceived anything so pathetic and terrible.

The lesson to the living may be brief and direct. Most mothers, in the abundance of their own ignorance, can not properly teach their daughters. Even wise fathers will not, ought not to, instruct those more precious to them than the blood of their own hearts, on such a delicate subject. Family physicians rarely have opportunities to give needed lessons. There is a little book, entitled "Hygiene for Girls," by Dr. Davis, which is the best that I know of on the subject. A father can give it to his daughter. A

mother can read it with her child, and profit by it herself. A teacher can put it in the hands of her pupil. A lady can give it to a young friend. The book contains information that will be greedily devoured, like the bread of physical life. The knowledge it imparts will make a healthier, wiser, better generation of women. It will save broken bodies and tragic sorrow. By means of it, or in some other good way, instruct girls before puberty, ere the ills come that make calamity of too long life.

XLII.

"The protection of the public health," says Bishop ("Criminal Law," § 489), "is an interest of the first importance to every government. Without health, the members of the community can not discharge duties either to the government or to one another. Therefore, anything of sufficient magnitude for the law's notice, calculated to impair the public health, is indictable at the common law."

XLIII.

"The public health, the welfare and safety of the community, are matters of paramount importance, to which all the pursuits, occupations, and employments of individuals, inconsistent with their preservation, must yield" (Commonwealth *vs.* Upton, 6 Gray, 473, opinion by Merrick, J.).

XLIV.

"While for obvious reasons," says Bishop ("Criminal Law," § 490), "a man is not punishable for being sick of a contagious disease, in his own house, though the house stands in a populous locality, and while his friends are not guilty of crime in declining to remove him; yet, if the sick man goes out into the public way, carrying with him his infection to the danger of the public, or if one takes out an infected child, this act, at the common law, subjects the doer to an indictment" (Boom *vs.* Utica, 2 Barb., 104; Rex *vs.* Vantandillo, 4 U. and S., 73; Rex *vs.* Burnett, 4 U. and S., 272; 1 East P. C., 226).

XLV.

"If a man has contagious disease in his house and fails to give due notice thereof, or allows people to come into his house without sufficient warning, or in any avoidable way exposes the public to contagion on his own premises, he is liable to indictment at the common law" (Meeker *vs.* Van Rensselaer, 15 Wend., 397; State *vs.* Purse, 4 McCord, 472; People *vs.* Townsend, 3 Hill, N. Y., 479; Welch *vs.* Stowell, 2 Doug., Mich., 332; Moffett *vs.* Brewer, 1 Greene, Iowa, 348; Barclay *vs.* Commonwealth, 1 Casey, 503).

XLVI.

Judge Dixon, of New Jersey, in a recent charge to the grand jury at Paterson, said: "If a man, con-

scious that he carries about with him the germs of contagious disease, recklessly exposes the health and lives of others, he is a public nuisance and a criminal, and may be held answerable for the results of his conduct. If death occurs through his recklessness, he may be indicted for manslaughter. It is held that where a person knowingly communicates a contagious disease to another and death results, the crime is that of manslaughter." Judge Dixon added: "The man may be indicted also for spreading the disease by conscious exposure of others thereto, by his presence in public places—such as on the streets, in halls, etc. He might be indicted as a public nuisance for endangering the public health in this way, even if no consequences had followed. The law provides some penalty for such offenses against the public safety" ("Medico-Legal Journal," vol. i, No. 3, p. 394).

XLVII.

The public has a right to demand that any premises wherein there is contagious disease shall be conspicuously placarded, under the direction of the sanitary authority. The citizen, whose premises are thus placarded, is thereby shielded from criminal or other liability on account of the disease. Any one entering the premises is thus duly warned, and enters at his own risk and peril. The general principles that should govern the public management of contagious diseases have been very clearly laid down by Mr. Simon, whose long experience in England, as the head of the national

public health administration, together with his conspicuous ability, especially qualify him to speak authoritatively on the subject. "Probably the public good will be seen to require," says the great English sanitarian, "with regard to every serious infectious disease which is apt to become epidemic, that the PRINCIPLES which ought to be accepted in a really practical sense, and to be embodied in effective LAW, are somewhat as follows: 1. That each case of such disease is a public danger, against which the public, as represented by its local sanitary authorities, is entitled to be warned by proper information. 2. That every man who, in his own person, or in that of any one under his charge, is the subject of such disease, or is in control of circumstances relating to it, is, in common duty toward his neighbors, bound to take every care which he can against the spreading of the infection; that, so far as he would not of his own accord do his duty, his neighbors ought to have ample and ready means of compelling him; and that he should be responsible for giving to the local sanitary authority notification of his case, in order that the authority may, as far as needful, satisfy itself as to the sufficiency of his precautions. 3. That, so far as he may, from ignorance, not understand the scope of his precautionary duties, or may, from poverty or other circumstances, be unable to fulfill them, the common interest is to give him liberally out of the common stock such guidance and such effectual help as may be wanting. 4. That, so far as he is voluntarily in default of his duty, he should not only be punished

by penalty as for an act of nuisance, but should be liable to pay pecuniary damages for whatever harm he occasions to others. 5. That the various commercial undertakings which, in certain contingencies, may be specially instrumental in the spreading of infection—water companies, dairies, laundries, boarding-schools, lodging-houses, inns, etc.—should respectively be subject to special rule and visitation in regard of the special dangers which they may occasion; and that the persons in authority in them should be held to strict account for whatever injury may be caused through neglect of rule. 6. Finally, that every local sanitary authority should always have at command, for the use of its district, such hospital accommodation for the sick, such means for their conveyance, such mortuary, such disinfection, establishment, and generally such planned arrangements and skilled service as may, in case of need, suffice for all probable requirements of the district" (Quain's "Dictionary of Medicine," p. 293).

XLVIII.

So far as the public sanitary agency is concerned, contagious and infectious diseases may be divided into two classes: (*a*) those that may be allowed to run their course, under the exclusive management of the family and the physician, and (*b*) those that should be combated under regulations provided by law to prevent their spread. In the first class may be reckoned chicken-pox, mild measles, whooping-cough, etc. In

the second class may be reckoned small-pox, scarlet fever, diphtheria, typhus fever, enteric fever, cholera, etc. It is not often that we have all the graver contagious and infectious diseases prevailing at the same time.

Some infectious diseases require to be regarded in the first or second class, according to the type of a prevailing epidemic. Sometimes a malignant form of measles prevails, when, for a period, it would be necessary to apply all the machinery of repression. Ordinarily, measles are not very dangerous, and, as the disease is inevitable sooner or later, and is less fatal in childhood than in advanced age, it is better to let it take its course. When scarlatina is of a very mild type, it would be as well to let it run, but for the very important fact that susceptibility and danger rapidly decrease after the first dozen or fifteen years of life. Enteric fever also becomes rarer and rarer after thirty years of age, and does not exist at all after forty-five or fifty. As one attack does not exempt from future attacks of diphtheria, the disease is always to be combated. It is not easy to decide when and to what extent the health authority should interfere in the execution of measures to suppress communicable diseases. In all cases, private and public effort should be intelligently combined in struggling against these foes of mankind. And sanitary officers should always be clothed with authority, expressed or implied, to use discretion in the enforcement of measures for preventing the spread of contagious and infectious diseases.

There is no fact better established than this, to wit, that all epidemic diseases are increased in virulence by conditions of filth and unwholesome habits of life. While the public health authority can do very little in regard to the manner of living among the people, it can do a great deal in the way of removing and preventing unsanitary conditions. All effort in that direction tends to destroy the food on which epidemic diseases feed. The channels through which contagious germs travel from person to person are numerous, and therefore the work of the health authority can not well be too comprehensive.

Isolation and disinfection, together with vaccination as preventive of small-pox, constitute the fundamental principles of such methods. The aim is to prevent as far as possible exposure of the non-infected to the infected, to close up the channels through which contagion is conveyed from the sick to the well, and to destroy the accumulations of disease-germs wherever they can be reached. Here, again, it is not easy to determine the best means and the least annoying ways. It is not at all difficult to find fault, without any obligation or inclination to suggest something better.

XLIX.

The proper person to report a case of infectious disease to the sanitary authority is the attending physician. The householder should also be required to report, if there is no physician in attendance. The police power of the State is ample to require such a

service to the public, both from physicians and householders. Members of the medical profession have sometimes objected to the performance of such service without compensation. In many places compensation is provided for, but the legal obligation does not rest upon the compensation; in that case the practitioner could forego the compensation and refuse to perform the service. All citizens can be required by the State to make reasonable sacrifices for the public good. Doctors are not exceptions to the rule. The objection has sometimes been made to statutes and ordinances requiring physicians to report cases of contagious diseases to the sanitary authority, that it involves the betrayal of the secrets of patients, and consequently a violation of professional honor. Just as though the fact that a man has small-pox, cholera, or some other pestilential disease could, or ought to be, a matter of secrecy between his physician and himself! Just as though a man had a right to violate just law by exposing others to his deadly communicable disease, and to require his medical attendant to become a *particeps criminis* by refusing to reveal it to the proper public authority! The medical oath has no such meaning. It might just as well be claimed that a surgeon ought not to testify before a criminal court concerning a wound received by a burglar in the act of breaking into a house. The American profession has never disgraced itself by seriously raising such an objection.

In this delicate matter, physicians should, as a rule, be treated with confidence by the sanitary authority.

A medical practitioner, in obedience to law, and in good faith, reports to a health-officer a case of infectious disease. If the health-officer were to go and inspect the case, re-diagnose the disease, and perhaps reverse the decision of the practitioner, and put the whole matter on public record, it would be a professional outrage, a piece of personal presumption—in fact, an official injustice. To send an inspector to do the same thing would be at least equally reprehensible. Still, the sanitary authority should always reserve to itself the right to investigate a case of real infectious disease concealed by either ignorance or fraud.

L.

Every case of infectious disease should be reported to the sanitary authority; then the sanitary authority should conspicuously placard the place where such case of infectious disease exists; schools should be notified of the case, and all children from the house rejected from school, till the case terminates and danger from "coming down" with the disease terminates; the inmates of the house should be prohibited from going out to engage in occupations in company with others; when such a case terminates in death, the undertaker having charge of the burial of the remains should not be allowed to take the corpse to a church or other public place for a funeral, to open the coffin for a view of the remains at the private funeral, or to allow young persons to act as pall-bearers; and when the case terminates by recovery or death, the premises should be

thoroughly disinfected under the supervision of the sanitary authority, and at the same time the disinfector, who ought to be an educated physician, should make a thorough examination of the premises for any sanitary defects, which should be clearly reported, if any are found, to the health-officer, to be dealt with under the law of nuisance. I have successfully carried out such a system in Milwaukee and Detroit, over a period of six years, and can speak somewhat positively of the results. Its advantages may be briefly stated :

1. It enables the health department, and the public through the health department, to know every day in the year the exact number of cases of infectious diseases in a city and their precise location. Rumor and sensational exaggeration in regard to the prevalence of contagious maladies, which are liable to alarm the people needlessly and to interfere with the pursuits of life, can then be corrected by facts. And the truth of a violent epidemic can not be suppressed in the interest of commerce, to the criminal endangering of the outside world.

2. The exact percentage of mortality is constantly known, revealing the severity or mildness of an epidemic.

3. The system affords especial means of studying the conditions under which contagious diseases flourish, or to what extent they are influenced by sanitary surroundings.

4. It diminishes the spread of contagious diseases by protecting large congregations of children in

schools from the presence of those bearing infection in their persons or clothes; by preventing exposure of the living at public funerals; by revealing to all who can see and read the places where such diseases may be caught, and by destroying the lingering germs of contagion in sick-rooms by means of thorough disinfection. My experience convinces me that a community will give a wide berth to small-pox, scarlet fever, or diphtheria if you will only let them know where it is. I have frequently seen quite small children cross over to the other side of the street when approaching a house on the door of which was placed a placard revealing the existence of contagious disease within. It is wicked to conceal from God's little ones the fountains of infectious suffering and death.

The difficulties of carrying out the system are considerable, but not insuperable:

1. While the majority of educated physicians are ready to co-operate with the health authority in carrying out any reasonable system of protecting the public from contagious diseases, the negligence of some and the perversity of a few must be overcome by the unflinching execution of the law. The medical practitioner depends upon the patronage of the public, and should be willing to do for the public at large a service that costs very little time and trouble, and is attended with no expense. The necessity of reporting to the health-office all deaths, with the causes, in order to get a permit to bury, puts the doctor on his good behavior. A few attempts to return croup for diphtheria, spotted fever for scarlatina, etc., may be

met with an order for a coroner's inquest. Inability to make a diagnosis has sometimes been urged as an excuse by delinquent quacks, but an unmistakable indication of criminal prosecution soon reveals to them that the responsibilities of assumed knowledge can not be voided by a plea of ignorance. In some instances doctors prematurely report recovery. The law of duration in contagious diseases is too well known to allow such heedlessness to escape notice and rebuke. It is sometimes disagreeable to supplement the mental and moral defects of a portion of the profession by the terror of criminal law, but faithful sanitary administration requires it.

2. At first the people object to having their houses placarded, as a violation of personal liberty. A little argument convinces reasonable citizens that no man has the natural or acquired right to expose his neighbors to deadly contagious disease by concealing it in his own house. Personal liberty to give small-pox to somebody else had better be abridged as soon as possible. Personal liberty to send scarlet fever into a school with your child is rather diabolical than beneficent. Personal liberty to infect a church with a diphtheria-corpse is tempting Providence to start an epidemic. A law-abiding community will submit, and soon the system of placarding, if it were left to an election, would receive a majority of votes in its favor. Experience proves its value in many ways to the citizen. He knows and feels that, by reason of it, his family is more secure against diseases that cost money, anxiety, and sorrow.

The defects of the system are already apparent to educated sanitarians :

1. So far as small-pox is concerned, proper vaccination and revaccination at suitable ages should be universal and compulsory. I am sorry to say that, in this respect, the sanitary code of most cities is defective. Without vaccination, suppression of the disease allows the greater accumulation of material for the conflagration of an epidemic, that sooner or later may get under way and defy all control. Every escape from scarlet fever is a positive gain, for susceptibility to the disease decreases with age. Diphtheria should be suppressed all the time, for one attack does not secure immunity in the future.

2. The efficiency of the system depends to a great extent on the willing or enforced co-operation of the medical profession. Just so far as the profession falls short of an ideal standard must the system fail to reach its ideal value, however well it may be administered.

The system in every place should be supplemented by a pest-house, to which the sick with contagious diseases, who have no homes, can be taken. With an efficient system of placarding and isolation, it is more economic, more humane, if not safer, to leave patients who have homes under the care of their families and friends. However excellent a hospital and its service may be, households are unwilling to give up any of their sick members to be nursed by unknown hands in a strange place. To force away children from parents, from brothers and sisters, and parents from

children and from one another, for the purpose of isolating infectious disease, exposes the public by transportation of the afflicted, diminishes the chances of recovery, outrages the unreasoning affections, and invades the sanctity of home. Sanitation must reckon with the unalterable instincts of humanity, and restrain itself within the boundaries of reasonable endeavor.

Therefore, in my judgment, the isolation of contagious and infectious diseases in the family, which is the unit of our political society and Christian civilization, is wisest and best. After long administrative training we shall get the willing co-operation of households and their chosen physicians. The day will come when exposure of others to our diseases will be recognized as a crime, the punishment of which will be demanded by the public conscience.

In the mean time we must combat superstition, diffuse rational knowledge, and protect the people against pestilence by the simplest and most effective means at our command, winning confidence by patient, kindly instruction, only using repression and the lash of the law when we must.

For the prevention of infectious diseases we are sadly in need of intelligent and trained private endeavor, as a supplement to public sanitation. Would that the clergy, taking for texts the hygienic precepts of Moses, which have not been surpassed by the revelations of modern science, might preach the gospel of cleanliness, and thus open up to their people new avenues of godliness! Would that we had in every

city a society of devoted men and women, like the Order of the Red Cross, whose especial duty it should be to go into the by-ways, not far from their own doors, and save from the perils of contagion and filth a greater number who perish, year by year, in times of peace, than ever die on the fields of battle in times of war! "Meanwhile," says the venerable Edwin Chadwick, the father of sanitation in England, "until justice is reclaimed for the administrative service in behalf of the public, as much as possible should be called for by appeal for voluntary effort. Of what this may do in preventing the spread of the ordinary foul-air epidemics, I will state the experience of a nurse of twenty years' practice, as a specialist in dealing with the most infectious and dangerous of them, namely, scarlet fever. Her chief practice was the common one in respect to all cases of the varied epidemics: to isolate the patient in a single room, the upper room, if possible, and let no one else enter it; to so arrange as to keep the door and part of the window open in order to let a current of air pass through the room over the patient; to observe all the details of regulations as to the cleanliness of the patient and the articles of clothing and furniture, and the removal of excreta, etc.; and as to her own personal protection, never to drink out of the same vessel that had been used by the patient, and to wash from head to foot twice a day with tepid water, and to change her clothes each day. With these precautions, she had never had a single case of the spread of the disease to a member of the family or any one else during the

twenty years, nor had she once contracted the disease herself."

LI.

Criminally careless physicians sometimes go from the bedside of patients laboring under contagious diseases, without disinfecting themselves, to see other patients, and may forget themselves so far as to follow the dirty and dangerous habit of kissing the baby. Mothers ought to punish them by pouring hot water on them long enough to disfigure them for life. If a doctor consciously exposes an innocent and confiding household in that way, he ought to be scalded to death. Law ought to be enacted making homicide excusable in such case. Heedlessness is not a valid excuse, and should be visited with the penalty of maiming, as a perpetual reminder. Lawyers are in the habit of descanting upon the case of Burke, who murdered people for the purpose of selling their dead bodies to the dissectors, as exhibiting the acme of human depravity and wickedness. Burke was a Christian and a gentleman in comparison with the medical fiend who connives at the spread of infectious disease in order to increase his practice.

LII.

Don't use patent disinfectants. They are all dear. Many of them are worthless. But few of them are effective. They are not only expensive, but may also be a delusion and a snare.

The best of all disinfectants is fire. Burn up dangerous things if you can. All rags and remnants of food that have been in contact with patients afflicted with diphtheria, scarlatina, cholera, or other infectious diseases, should be thrown promptly into the fire. Do not leave them about to add to the volume of poison generated in the sick-room, or to be handled by the ignorant or unwary. A large part of garbage, that would soon putrefy and become dangerous, may be burned, when there is no other ready means of its disposal.

Heat is akin to fire. All washable clothes, for the person or beds, may be disinfected by boiling. Cook the germs of disease, and they will never sprout or hatch. Every household, however poor, can command boiling water. Don't lay aside sheets, towels, pillow-cases, pocket-handkerchiefs, night-gowns, or other articles of the kind, that have been in contact with the sick, to be washed at a convenient or leisure time, but boil them for an hour or two at once. Few households have conveniences for disinfecting with dry heat. Articles that can not be boiled without spoiling, may be safely and effectively baked at a temperature of 240° Fahr. As I have said elsewhere, the best of all means for disinfecting ships is dry steam.

Next in general value is fresh air—plenty of it, in constant currents. Sunlight should be abundantly mixed with it as an adjuvant. The oxygen of pure air kindles a slow fire in all filth with which it comes in contact. Ozone, sometimes abounding in the atmosphere, is still more potent. Cover up, head and

all, your poor patient, languishing with infectious disease, and throw wide open, for a minute or two every window and door of the chamber, at least once an hour. It is not only good for the sick, but also lessens the danger to the attendants.

The really useful chemical disinfectants are few in number, and for the most part very cheap. Chlorine gas is the most potent, but is dangerous to use, and may be passed by. Nitrous-acid gas is next in potency, but is also too dangerous. Sulphurous-acid gas is sufficiently effective, and may be safely managed with care. Close a room tight, and burn in it one pound of sulphur for every thousand cubic feet of air-space. A room fifteen feet square and twelve feet high would require nearly three pounds. Carpets that have not been removed during sickness with contagious disease should be left down, blankets and mattresses should be hung over chairs, while disinfection is going on. The sulphurous-acid gas will kill plants and birds, and you, too, if you attempt to stay in the room. Leave the room closed at least three hours, and then air it out. Be careful not to set fire to the house, or burn a hole in the carpet. Fill a coal-scuttle or deep pan half full of coal-ashes, put on the ashes some live coals, and then put the brimstone on the coals. A public disinfector will find a mixture of seven parts of flowers of sulphur, two parts saltpeter, and one half part of camphor, intimately ground together, most convenient, for it will freely burn in paper packages without the coals, which are not always convenient to obtain. A skilled disinfector can save all

household articles, without risk, even after small-pox, by means of sulphurous-acid gas.

Add to this invaluable aërial disinfectant acetic acid, hydrochloric acid, corrosive sublimate, and copperas, for other purposes, and we need not bother ourselves about the rest. Carbolic acid, so called, which is no acid at all, is not only a delusion, but it betrays by false promises. It is an excellent antiseptic, but is not a disinfectant.

Acetic acid is a precious disinfectant. The best form of it—the glacial aromatic acid—is very costly, and can be used only by the rich. Common vinegar —another form of it—is very cheap, and is found in every household, however poor. Everybody has heard of the four thieves, who, during the plague of Marseilles, plundered the dead without infection. They were condemned to death, but were promised immunity if they would reveal the means whereby they escaped infection from the plague.

Their security was simply from the use of aromatic vinegar, which, for this reason, is sometimes still called in France "*le vinaigre des quatres voleurs*"—the vinegar of the four thieves. Cardinal Wolsey protected himself from the infection of the crowd by a sponge filled with vinegar, carried in an orange-peel. A dish of vinegar, into which has been thrown a handful of aromatic herbs—rue, rose-leaves, etc.—evaporating over a lamp or on a stove in a sick-room, is a powerful disinfectant, and greatly aids protection of the attendants from contagion. It is not so efficacious as burning little pinches of sulphur every hour throughout a

house in which are patients with infectious disease, but is the next thing to it.

There is nothing better than hydrochloric acid, one part to twenty of water, for disinfecting the excreta of cholera and typhoid patients, and, in general, of all patients laboring under contagious and pestilential diseases. Body and bed clothes, contaminated by such patients, may be soaked in it, if opportunity for boiling the same be wanting. A solution of corrosive sublimate, half a drachm to the gallon of water, is a good substitute for diluted hydrochloric acid. It is objected to corrosive sublimate that it is a virulent poison. The same objection might be urged to hydrochloric acid. Neither should be intrusted to children and fools. An astonishingly small quantity of corrosive sublimate in water will devitalize germs, both animal and vegetable, as elaborate experiments in Germany have recently proved.

It must not be forgotten that deodorizers are not always disinfectants. On the other hand, disinfectants are not always deodorizers. A solution of copperas, one pound to the gallon of water, is a cheap deodorizer, and a very good disinfector of foul drains and cesspools. As Professor John Dougal, of Glasgow, has abundantly demonstrated, acids change the process of putrefaction into the less dangerous process of fermentation, and must be chiefly relied on as chemical disinfectants. Experience proves that a majority of physicians, educated to cure, not to prevent, disease, know as little about disinfection as other people. Only the other day a busy practitioner of medicine

informed me, in good faith, that he had just thoroughly disinfected a house after diphtheria by carrying around from room to room a pan of coals with an ounce of surphur burning thereon, and did not quite comprehend the sarcasm of the inquiry, whether he thought he could stand more sulphurous-acid gas than a bacterium termo.

LIII.

The venerable Edwin Chadwick sums up the fruitful sanitary experience of half a century in the following conclusions :

"That cases of small-pox, of typhus, and of others of the ordinary epidemics, occur in the greatest proportion, on common conditions of foul air, from stagnant putrefaction, from bad house-drainage, from sewers of deposit, from excrement-sodden sites, from filthy street surfaces, from impure water, and from overcrowding in foul houses ;

"That the entire removal of such conditions by complete sanitation and by improved dwellings is the effectual prevention of diseases of those species, and of ordinary as well as of extraordinary epidemic visitations ;

"That where such diseases continue to occur, their spread is best prevented by the separation of the unaffected from the affected, by home treatment if possible ; if not, by providing small temporary accommodation ; in either case obviating the necessity of removing the sick to a distance, and the danger of

aggregating epidemic cases in large hospitals—a proceeding liable to augment the death-rates during epidemics;

"That skillful and complete works of sanitation and the removal of the conditions of stagnancy and putrefactive decomposition, are the most efficient means of reducing the expenses of excessive sickness and death-rates."*

LIV.

It is impossible, with any reasonable outlay, to inspect all meat sold in many places scattered over a city. Besides, the inspection of animals before they are slaughtered is even more necessary than the inspection of meat. If all slaughtering were done at an abattoir, one experienced and skilled man could inspect an immense amount of stock when ready to be killed. Diseased, maimed, feverish, or over-wearied animals could be sorted from the healthy. Doubtful animals could be marked and the vital organs of such might be examined after slaughtering, in order to determine their fitness for human food. Good butchers would rejoice in such a course by the public sanitary authority, for they have no inclination to supply the people with unwholesome meat. Those who thrive by swindling the ignorant and the poor, at any cost to the health or even life of their victims, would find their occupation gone, and turn their attention to some less guarded field of industry. The whole community would

* Address before the British Health Congress, December, 1881.

be protected against the purchase of unsound meat. When it is remembered that the foul tape-worm comes from eating "measly" pork; that the deadly trichina comes to the human stomach from the flesh of swine; that sheep and cattle are liable to chronic or acute diseases which render their flesh unwholesome or dangerous to man; that unprincipled butchers slaughter animals too young or too lean for food—it will be acknowledged that intelligent and conscientious inspection is a great safeguard to the public. Professor Gamgee, speaking of the maladies of cattle, says: "Many of the worst forms of disease are very sudden, and only slightly affect the color and texture of the muscular apparatus. A fine, fat bullock, with florid meat, may have died from splenic apoplexy, or been merely killed *pro forma*, when already on the point of death. Remove the spleen, and the carcass appears sound. Yet dogs and pigs die from eating, although first cooked, any portion of such cattle." It is known that a poison is very rapidly generated throughout the entire system of a severely bruised animal, yet such are slaughtered for the market and sold to the sausage-maker, if not to the dispenser of fat beef. Half-dead animals mysteriously disappear from stock-yards, and nobody seems to know where they go. If the meat-supply of a city were confined to an abattoir, where all stock must be inspected before slaughtering, the dangers would be removed.

LV.

What are the objections to slaughtering-places in a city? Ask the people who live in their vicinity, and they will answer with an eloquence inspired by the perpetual discomfort of noise and stench, and by the depreciation in the value of their homes. The driving of cattle to such places is a danger and an obstruction to the public streets. The noise of animals, by night as well as day, irritates the nerves and destroys sleep. Women and children can not help seeing from windows opening upon uncovered slaughter-yards, here and there in a city, the butcher plying his trade. To many it is a distressing sight. Scenes of brutality are sometimes witnessed that shock all but the hardened. The murderous axe and the knife red with blood are not suggestive of the humanizing sympathies. The smell of offal, even when it is untainted, is repulsive; and windows on the side of the slaughter-house must be closed in summer, when fresh air is needed. The yards where animals destined to slaughter are kept, become foul with excreta and send up poisonous exhalations. Not unfrequently the refuse of slaughtering putrefies before it can be removed, and adds to discomfort a source of disease. The plaintive cry of dumb creatures, that seem to have an instinct of their fate, sounds mournful to the human ear, and tempers hearts to sadness that might otherwise be glad.

The depreciation of real estate in the neighborhood of slaughter-houses amounts to much more than

the whole value of a business that might be conducted more profitably elsewhere. In some places the depreciation is fully one half. Butchers have no right to tax their fellow-citizens so heavily for their own convenience. A meat-market is not offensive; when kept clean and neat, it is even attractive. But no care can make a slaughtering-place anything but a nuisance.

LVI.

By concentrating the slaughtering-business of a city, subject to expert inspection, a great deal of cruelty to the dumb creatures on which we feed might be prevented. There is no doubt that driving cattle, and especially swine, sorely tries the temper. But the seeming perversity of an excited, wearied, bewildered animal, on its unknown death-march to sepulture in the human stomach, is no excuse for brutality in man. I have seen creatures, that walk on two legs and wear clothes, stabbing cattle and swine with a pike, inflicting wounds never to be healed. The pole, in the end of which the pike is fixed, sometimes equals in length and size the handle of a pitchfork. The pike-end of it is protected from splitting by a heavy ferule of iron or brass. The drivers not unfrequently stab and maul the poor creatures with this formidable instrument of savage warfare, till they are bruised and pierced into a condition unfit for slaughter.

LVII.

We owe it to the dumb creatures that are helpless and unable to plead for themselves, to kill them as painlessly as possible, when we slaughter them for food. The English poleaxe is a much better instrument of death than a sledge-hammer. In France and Germany, the *bouterolle à la masque, Schlachtmaske,* "slaughtering-mask," has been invented and humanely used. It consists of a hood, which is thrown over the animal's face, provided with a circular iron plate, that rests upon the forehead, between the eyes; in the center of the plate is a steel punch, which can be driven into the brain by a single smart blow with a hammer. If necessary, an iron rod may then be used to break up the base of the brain by thrusting it into the perforation. A German newspaper sums up the advantages of the mask as follows: "1. The duration of suffering is reduced to almost nothing. 2. The flesh and internal organs are in better condition. 3. The brain is natural in appearance, not congested. 4. Less strength and less exposure to danger of being injured are necessary on the part of the butchers."*

If all slaughtering for a city were done in a suitable abattoir, with proper appliances, and under the eye of an inspector, the brutalities complained of would become unknown. There are human beings who even take pleasure in the dying-agonies of ani-

* See Dr. Folsom's article in the "Sixth Annual Report of the State Board of Health of Massachusetts," p. 181, where he gives a woodcut of the instrument.

mals. Cruelty to the brute creation reacts and produces its harvest of inhumanity and violence to society. The youth who grows merry over his awkward and ineffectual blows at the head of a bullock with a sledge-hammer is educating himself to brutal treatment of his fellow-men. And Nature swiftly breeds poison in every fiber of the terrified, enraged, and abused beast, wherewith to punish a community of beef-eaters for their ignorant or criminal indifference.

LVIII.

A competent eye-witness, writing to the "New York Tribune" from Chicago, thus describes the shocking cruelty practiced upon animals in transit:

"Some idea of the condition of the animals on arriving at Chicago may be formed when it is known that the dead hogs average fully one to a car-load, and this when the weather and other conditions are favorable, while a careful inspection of the books of the railroads shows that the dead cattle, including those which are so badly crippled as to have no greater commercial value than if dead, average about five per day. These dead animals include only those which have died since leaving the last preceding feeding-station, where the dead and badly wounded were not reloaded. If, by a supreme effort, induced by extreme torture and a desire to accompany its companions, the animal can rise to its feet and leave the car, the animal is classed as sound. I saw a poor creature, after repeated and most desperate efforts,

succeed in rising to its feet, after it had been dragged from the car, and, trembling violently in every part of the body, it was finally able to follow its companions. The shouts and thrusts of the attendants in another car that had just arrived at the yards had no effect upon a steer which had been forced down and trampled upon by its comrades until it was severely wounded; but a dexterous twist of the tail, giving a violent shock to the spinal column, started the animal, and it made a last desperate effort to rise, but in vain, and further twisting of the tail and kicks and shouting were of no avail. Unable to hold its head up longer, it submitted quietly to all the cruelty that was practiced upon it. It was dying. The records show that the number of those that reach the Chicago yards in this condition is greater than that of the actually dead. Broken horns, with the blood dripping from them, and other evidences of injury, are seen on almost every train."

LIX.

Mr. Henry Bergh (who could not, if he would, speak with exaggeration on this subject) truly says:

"The truth should be known to the consumers of the flesh of sick and dying animals, starved and pounded during a journey of many days' duration. On arrival at their places of destination, they are at once driven into the slaughter-houses, almost frantic from the consequences of the treatment which so-called civilized beings have made them endure, burn-

ing with fever, lame, and covered with deep-sunken ulcers, and they are killed and dressed for the market; and, horrible to think of, the meat is perhaps on the next day placed upon the tables of the citizens and restaurants of the city, and eaten and absorbed by its apathetic or unsuspecting consumers. Familiarity with these soulless and disgusting proceedings has almost converted the writer into a strict vegetarian. He has seen the carcasses of animals suspended in the abattoirs in and around New York, awaiting transportation to the markets, which exhibited revolting sores and ulcers, sometimes a foot in diameter."

In answer to the question, "What are you going to do about it?" Mr. Bergh says:

"Three remedies are practicable in case the people see fit to wake up from their slumber: 1. Rebellion against the railroad tyrants by forcing a stringent law through Congress compelling these corporations to change this system of cattle transportation entirely, and placing the enforcement of that law either in the hands of government officials, or in those of the societies for the prevention of cruelty to animals, along the whole route of transportation, reimbursing them their expenses. 2. By obliging stock-companies to slaughter the animals near their grazing-grounds, and bring the meat to market in refrigerator-cars. 3. In case these are not attainable, the refraining from the use of meat altogether."

There is another remedy which Mr. Bergh does not mention. Every city should be provided with one or more public abattoirs, in the open country ad-

joining, to which are attached wide fields for summer and vast sheds for winter use, in which cattle can be fed and cared for in a humane way, until they entirely recover from the fever, injuries, and fright of a long journey, before they are slaughtered for food. Whether the cattle arrive in cars or in droves, they should be kept, under conditions of health, until a skilled inspector pronounces them fit for slaughter.

LX.

The police power of a State inheres in its sovereignty, and is ample to establish abattoirs, even exclusive abattoirs ("Slaughter-House Cases," 16 Wall., 36). "In Louisiana," to use the language of Judge Cooley, "the State went so far for the protection of New Orleans against the customary evils of slaughter-houses as to give to a company of individuals a monopoly of the slaughtering of cattle for the market—an exercise of power that at first blush is startling; but it has been fully sustained by State and Federal authorities" ("Michigan State Board of Health Report," 1882, page 14).

No man need suffer unreasonably from a slaughter-house in proximity to his habitation, for the common law furnishes him a remedy. "Slaughter-houses are regarded as *prima facie* nuisances, and their existence so near to dwellings as to impair their comfortable enjoyment is an actionable injury" (Wood's "Law of Nuisances," second edition, page 657). All the sufferer has to do is to employ a good lawyer, and

prosecute the owner of the slaughter-house in private damages. "So far as injuries to private rights are concerned, parties are usually left to their common-law remedies" (ibid., page 663).

LXI.

There is but one proper remedy for the adulteration of foods and drinks, and that is to apply the existing criminal law to the adulterators. If a manufacturer or dealer mixes glucose with cane-sugar, and sells the mixture as pure sugar, apply to him the statute of fraud. If a dairyman waters his milk, and sells the resulting fluid as pure milk, treat him as a swindler. If a baker puts alum in his bread, to conceal poor flour, treat him as one knowingly administering that substance for the purpose of causing all the results produced by it. If the brewer puts in his beer carbonate of soda, lime, copperas, sulphuric acid, aloes, colocynth, santonin, cocculus Indicus, nux vomica, strychnine, tobacco, picric acid, copper, lead, or other deleterious substance, apply to him the criminal law against administering poisons with intent to injure or kill. If an importer puts upon the market green teas "faced" with Prussian blue, indigo, clay, gypsum, chalk, curcuma, carbonate of copper, or acetate of copper; or black teas to which a "bloom" is given by black lead; or teas with the leaves of which are mixed leaves of sloe, oak, beech, willow, plane, poplar, chestnut, or hawthorn—his cargo should be condemned and destroyed in the first instance, and

after that, for a new offense, he should be treated as a swindler or poisoner. The Chinese will stop adulterating teas as soon as cargoes of the stuff are condemned and thrown into the sea. Brewers will confine themselves to barley-malt and hop-extracts when two or three of their number are sent to the penitentiary for using dangerous drugs to cheapen their processes. The public seems to lack sufficient moral health and vigor to beget wholesome indignation against the perpetrators of fraud and crime in trade and commerce.

The same principle should be applied to those who tint wall-papers with arsenical pigments, or color articles of wearing-apparel with poisonous aniline dyes.

LXII.

Vaccination, isolation, and disinfection are the means upon which sanitarians must rely in combating small-pox. The methods of using these preventives are of great importance. Not only diligence is required, but also accurate knowledge of the natural history, thus to speak, of this loathsome malady. Certain enumerated facts concerning it may be given to facilitate reference :

1. As a rule, small-pox manifests itself on the twelfth day, or thirteen times twenty-four hours, after infection. The most obvious subjective symptoms are fever, headache, back-ache (spine-ache), and nausea. Two days afterward, or thirteen times twenty-four hours after taking the disease, eruption appears, at

first in bright-red pimples, with a hard, shot-like base, which in due time develop into vesicles, at first rounded, then depressed or umbilicated, afterward into pustules, which finally become scabs and fall off, leaving pock-marks. The object here is not to describe the disease from a medical point of view, but to indicate certain landmarks from a sanitary point of view.

2. The best pathologists regard small-pox as not contagious during the first two days of fever, headache, back-ache, and nausea. This is the precious period during which the sanitarian may get in his preventive work. The symptoms during the two or three days of primary fever and first papular eruption are striking enough to put the properly educated and wary medical attendant on his guard, and he should lose no time in communicating his suspicions to the health authority, whose duty it is to protect the public. The victim of the disease may be isolated without endangering even the members of the same family. The patient may be removed to the proper hospital, and the household may go on in safety, or members of the family may be removed to some other place, leaving patient and attendants in possession of the house.

3. The eleven days of incubation afford a precious period for the observation of those who have been exposed, and to make preparations for their care, if they should be overtaken by the malady. During that period they are perfectly safe to others, and may be allowed to come and go at their will. As the time of probation draws near its close, they should report

to the health-officer, or be visited by him, for the purpose of observing the first symptoms of the disease. Such suspects should be treated with the greatest kindness and sympathy, while strict obedience must be required of them for the good of others. I have had no trouble in dealing with such, and have made them feel that the health authority, while necessarily inflexible, is their best and most helpful friend. Cases of noble self-sacrifice have been met with, worthy of enduring record. A wrestle with loathsome pestilence, during which the light of life may be extinguished, and the final resting-place be reached in the solitude of night, without the presence of mourning friends, is not pleasant to contemplate, and can be fully appreciated only by those who have looked the situation in the face.

4. Vaccination, always an armed friend against the dangerous foe, is especially precious in the hour of exposure. Well performed, with reliable virus, it will overtake small-pox and at least modify it into varioloid, when resorted to within three days after infection. It is the sling of David with which the giant may be slain. The arguments in favor of vaccination can not be too often repeated.

In comparison with the long ages of man's life on this planet, vaccination is a new thing. Less than a century ago Jenner published his discovery to the world. Not a hundred years have elapsed, yet the most dreaded of diseases to which man is subject has already lost the greater part of its terrors. Against the inertia of indolence and apathy, against igno-

rance and superstition, against dullness and prejudice, against heavy conservatism and unreasoning tradition, the practice of vaccination has spread in a few decades over the whole civilized world, to the vast benefit of mankind.

A few salient facts and groups of facts will demonstrate to any rational human being the immeasurable utility of vaccination:

(*a.*) The great mass of people in all enlightened nations have come to believe in it, from observation and experience. *Vox populi, vox Dei.* Enlightened public opinion is a very good although not infallible criterion of truth.

(*b.*) Educated medical men are almost unanimous in favor of vaccination. John Simon addressed a question, "purposely construed to elicit the expression of every existing doubt on the protective influence of vaccination," to five hundred and forty-two distinguished medical men, British and foreign, and received an affirmative answer from all but two of them. The British Epidemiological Society published a report of its small-pox and vaccination committee in 1853, wherein reference is made to favorable answers from more than two thousand British medical men, besides many in other countries. In America to-day, as well as in other countries, the physicians who do not favor vaccination are exceptions to the general rule.

(*c.*) The governments of nearly all civilized nations favor vaccination, and some of them make it compulsory. The British and German Governments, both of

them conservative and enlightened, require it. The Legislature of nearly every State in this Union has enacted a law favoring it.

(*d.*) Statistics on a large scale demonstrate the utility of vaccination. In Moravia, Bohemia, and Austrian Silesia, vaccination reduced the annual mortality of 4,000 in every million of population, by small-pox, to 200. In Westphalia, where the death-rate from small-pox was formerly 2,643 in the million of population, the annual mortality from the same cause declined to an average of 114 in the million from 1816 to 1850, under the influence of general vaccination. From 1810 to 1850 the yearly death-rate from small-pox in Sweden was 158 per million of population, but was 2,050 before vaccination. In Berlin the reduction was from 3,422 to 176; in Copenhagen, from 4,000 to 200. At the close of the last century the estimated rate in England was 3,000. The average rate of 1841–'53 was 304. The average rate of 1854–'63, embracing two severe epidemics, was 171 per million of population. Yet there are men, apparently rational, who denounce vaccination, without suspecting that they are making themselves public malefactors.

(*e.*) Special statistics demonstrate the benefits of vaccination not less strikingly than general statistics. Dr. Seaton and Dr. Buchanan, both of them skilled observers, examined, in various London schools and work-houses, during the epidemic of small-pox in 1863, over 50,000 children. A large majority of them had been vaccinated in various ways and degrees. Three

hundred and sixty out of every thousand who had not been vaccinated were scarred with small-pox. Less than two in 1,000 of those who showed evidence of vaccination had small-pox marks. Only one in over 1,600 who had perfect vaccine marks showed pitting from small-pox. Mr. Marson observed and carefully recorded 30,000 cases of small-pox under his personal care in the London Small-pox Hospital. Deaths among the unvaccinated were 37 per cent; among the vaccinated, 6½ per cent.

The general drift of statistics on the subject, collected during the current century, is in the same direction. I have no doubt that an epidemic of small-pox in the United States, without the protection afforded by vaccination, would be quite as calamitous as the great war of the rebellion. Were the protection as perfect as it might be, we should scarcely know of the existence of small-pox.

Efficient vaccination—that is, vaccination with pure virus and properly performed—is, in my judgment, just as complete protection against small-pox as an attack of the disease in the natural way. "Duly and efficiently performed," said Jenner, "it will protect the constitution from subsequent attacks of small-pox as much as the disease itself will. I never expected it would do more; and it will not, I believe, do less." Nature does her work perfectly. The element of art enters into vaccination, and the degree of its success depends upon the material used and the skill of the operator. The best vaccinator can not produce good results with imperfect matter. The best

virus may fail in the hands of a bungler. If such grand results in favor of vaccination, as already presented, are attained by work that is imperfect, what might we not expect with the science, skill, and pains which are surely within human reach? Failure of vaccination may involve consequences more dangerous to the individual than the amputation of an arm. Yet we seek a careful and skilled surgeon to perform the latter operation, while any blunderhead is supposed to be capable of performing the former. The surgeon is contented with only the best instruments and dressings when he undertakes a capital amputation. Yet, when he undertakes to protect a fellow-being against a disease which, taken in its natural form, kills four out of ten of all who have it, he sometimes uses any kind of knife, and exercises less care in the selection of virus than he would in the choice of a sleeve-button. As pointed out in one of the reports of the medical officer of the British Privy Council, the degree of protection afforded by vaccination varies as one to thirty. And the worst of it is that slovenly vaccination, with imperfect or worthless virus, brings the great and beneficent discovery of Jenner into disrepute.

LXIII.

Going the other day from Albany to New York, I discovered a prolific source of enteroid fever. There are miles of ice-houses not far below the former city. The river at that point is polluted with the sewage of Albany, Troy, and other considerable towns. It was

a just conclusion of the Rivers' Pollution Commission of the British Parliament that there is not a river in the kingdom long enough to purify water contaminated by sewage. Everybody will admit that the water of the Hudson a dozen miles below Albany is not pure; but many deluded people, and some interested people who are not deluded, will claim that ice is free from the impurities of the water on which it is frozen. Such a claim is a delusion and a snare. Typhoid fever has been traced to impure ice.

As in our climate, during the hot months of summer, it requires about the same weight of ice as water to make the latter palatable to drink, it is necessary to exercise equal care about the purity of both. It not unfrequently happens that an outcry is made about the impurity of drinking-water, when in reality the fault is in the ice mixed with it. Ice is supplied to families in cities cut on rivers below the discharge of sewers where no mortal would think of drinking the water. Ponds in suburbs, the water of which is repulsive even to look at, furnish crystal ice, which people, otherwise prudent and careful, put in their refrigerators, and use in contact with fish, poultry, fruit, and other delicate food. The essential poisons of sewage are mingled with lemonade and other cooling drinks, by means of the ice used abundantly in their preparation. The spores of microscopic plants, of deleterious cryptogams, living in putrescent stagnant water, may be "imprisoned in thick-ribbed ice," and conveyed to the stomach in a draught that refreshes on a hot summer day.

At Rye Beach, in New Hampshire, an attractive summer resort, there was mysterious sickness in one of the large hotels in the summer of 1875. "A disturbance of the digestive system, characterized by a sensation of giddiness and nausea, vomiting, diarrhœa, severe abdominal pains—all of which was accompanied by fever, loss of appetite, continued indigestion, and mental depression," was a professional description of the sickness prevalent in that particular hotel. At length it was discovered that the "crystal" ice used was cut from a stagnant pond in the vicinity, the water of which smelled very bad in summer. There was no bad smell in the ice. It was clear in color, and only chemical examination compelled belief in its impurity. The result of the analysis, expressed as usual in 100,000 parts, was as follows :

Ammonia	0·0208
Albuminoid ammonia	0·0704
Inorganic matter	7·80
Organic and volatile matter	5·72
Total solids at 212° Fahr.	13·52
Chlorine (when filtered)	3·23

A specimen of pure ice, analyzed at the same time, gave 0·76 of total solids and 0·02 of chlorine.

Of course, the ice was not as bad as the water from which it was cut, yet it was bad enough to sicken and endanger many people in the midst of otherwise healthful circumstances.*

* For a fuller account of impurities in ice, see a paper by A. H. Nichols, M. D., in the "Seventh Report of the Massachusetts State Board of Health," 1876, p. 465. His conclusions were verified by

Extensive and careful experiments have been made in the laboratory of Michigan University, under the competent supervision of Professor Vaughan, on the purification of both crystalloids and colloids by freezing, from which the conclusion is reached that "pure ice can only come from pure water." It is not necessary to multiply proofs. It is very certain that the ice-supply of a city needs sanitary supervision. The one essential rule is that ice should not be gathered for household use, for use in connection with foods and drinks, from water that would not be used for the same purpose. "Safety demands," says Professor William R. Nichols, a very high authority, "that it should not be cut for domestic use on ponds or streams which are so polluted as to be rejected for water-supply."

LXIV.

During the winter of 1881–'82, when small-pox was epidemic, I allowed fourteen well persons to go to the pest-house in the city of Detroit, who wished to take charge of other members of their families removed there on account of the disease. All of them were vaccinated or revaccinated at the time of going. Not one of them had even a light attack of varioloid. When the anti-vaccinationists will show half, or even quarter, the number of unvaccinated persons exposed

Professor S. P. Sharples, Professor E. S. Wood, and Professor W. B. Hills, in 1879. (See the "Tenth Massachusetts State Board of Health Report," 1879, pp. 119, 120.)

in the midst of the sick and the dying to concentrated contagion without the least injury, I will then listen patiently to their arguments. Dr. Henry Tomkins, Medical Superintendent of the Fever Hospital belonging to the Manchester Royal Infirmary at Monsall, in a paper recently read at Owens College, said:

"The most striking of all evidence is, perhaps, that derived from the small-pox hospitals themselves. Here the protective influence of vaccination is seen and proved in a manner beyond all cavil. At Highgate, during an experience of forty years, no nurse or servant having been revaccinated has ever contracted disease, and evidence of the same character I can myself bring forward; for during the whole time that I have had charge of the fever hospital more than a thousand cases of small-pox have passed under my care, yet no servant, nurse, porter, or other person engaged there, has, after revaccination, ever taken it, though exposed daily to infection in its most concentrated form. . . . Again, among all the students who, during the past two years, have attended the hospital for clinical instruction, not one has suffered, all having been revaccinated before being permitted to enter the small-pox wards. . . . I defy the most enthusiastic or conscientious of anti-vaccinators to produce evidence like this on his side of the question, or to bring forward even half a dozen persons, choose them whence he may, who have not been protected against small-pox, and expose them as the students are exposed, without more or less of the number taking the disease. Facts such as these should convert the most

ardent anti-vaccinator from his folly, and convince him that a weapon of defense so powerful as vaccination should not be left to the pleasure of the individual, but that the State has the right and duty to look after its most thorough performance."

In view of such facts, it may be unhesitatingly concluded that the sanitary authority has the right, and duty requires it, to remove to the pest-house a homeless person who is reasonably suspected of having small-pox. If the precaution is taken to properly vaccinate him, he is almost certainly safe. The public is entitled to the benefit of the doubt, especially when the danger to the public is a million times greater than the danger to the suspected individual. I have known small-pox to be disseminated through a city, simply by diagnosing a case of varioloid as chicken-pox. *Salus populi est lex suprema.*

LXV.

India is the home of cholera. There are accounts of earlier epidemics, but our authentic history of cholera dates from 1817. In that year it broke out in the city of Jessora, northeast of Calcutta, and spread over all British India. The mortality is given as 600,000. In 1818 it spread over all Bengal, to Nepaul, along the whole coast of Coromandel, and to Sumatra. Of General Hastings's army of 18,000 men, 9,000 died in a short time. In 1819 it first traversed the sea, and broke out in Ceylon, Isle of France, and Isle of Bourbon. This third wave of cholera was not so

severe in India as the first two, but extended farther —40° in latitude, 50° in longitude. In 1820 it was more severe all round, and extended to the Philippines and to China. In 1821 the wave was still more destructive, extending eastward to Borneo and Java, westward to Persia—through 43° of latitude and 70° of longitude. In 1822 the wave rolled on toward Europe, into Mesopotamia and Syria. In 1823 it swept up through the Chinese Empire, northwestward to the coast of the Mediterranean, along the shores of the Caspian to Orenburg, in Russia, on the extreme confines of Europe. It was already 4,500 miles away from its starting-point in Jessora. A lull of three years followed, without further extension. In 1827 it broke out with renewed intensity in India, and spread to the Himalayas and the Sea of Aral. In the next two years, 1828–'29, it was less savage, and extended little. In 1830 a higher wave swept over the Caucasian Mountains, around the Caspian and Black Seas, up the Volga, the Don, and the Dnieper, to many cities of Russia. In the spring of 1831 a new wave started from India, swept westward through Medina and Mecca, traveled with pilgrims to Egypt, killed 30,000 in Cairo, ascended the Nile, reached Smyrna and Constantinople, ascended the Danube to Vienna, went to the extreme north of Russia, traversed Poland to all Northern Germany, spared the region of the Rhine, barely touched Scandinavia and the coast of England. In 1832 it swept over Great Britain and Ireland, crossed the Channel to France, killed one forty-third of the people of Paris, traversed the Atlantic Ocean,

murderously attacked Quebec, Montreal, New York, Philadelphia, Baltimore, and other cities, and descended the rivers to New Orleans. In 1833 it desolated Mexico, and swept over all the rest of the North American Continent. In 1834 it ebbed back to Portugal and Spain, and desolated the northern coast of the Mediterranean as far as the Adriatic. The next year, 1835, it crossed to Northern Africa and attacked the whole Barbary coast, and killed one-fortieth of the inhabitants of Malta. In the following years, 1836–'37, it eddied around Central Europe, in Germany, the Tyrol, Bavaria, and Italy. After this fierce and far-spreading epidemic of twenty years, there was a brief lull, but not entire cessation, of cholera.

At the beginning of 1840 a fresh wave started from the Ganges, more rapid, more destructive in its flow than the first. It is not necessary to follow it with chronological minuteness. In 1845 we see cholera ascending the Tigris and Euphrates, from Bagdad through Persia and the adjacent countries. In 1846 it again crossed Arabia, slaughtering multitudes of pilgrims at Mecca. In 1847 it attacked Constantinople savagely, from which, as a center, it radiated in all directions, especially through Eastern Europe. In 1848 it again visited Germany, this time murderously, and crossed over the ocean to New Orleans, in this country, whence it spread the following year. In 1849 its ravages were so severe at Paris and in all France as to fill the whole country with terror. In this year it prevailed almost everywhere on both sides of the ocean.

This epidemic was followed by another, almost without interruption. In 1851 and 1852 it devastated a large region of Western Asia, especially Persia. In 1852 Russia suffered severely. In 1852 and 1853 Poland and Northern Germany were sorely revisited. The Scandinavian nations were then very fiercely attacked. In 1853 and 1854 Great Britain, France, and the United States were again bitterly punished. In 1854 and 1855 the pestilence prevailed in all the countries bordering the Mediterranean on the north. Switzerland, which had escaped the previous epidemic, then suffered severely. In 1855 South America was first visited. Many have not forgotten how it added terror at this time to the Crimean War.

In 1860, 1861, and 1862 cholera again prevailed fearfully throughout India. In 1864 and 1865 it journeyed westward, crossed Arabia, entered Egypt with pilgrims from Mecca, whence it spread over Europe and America. In 1866 more soldiers perished by cholera during the Austro-Prussian War than fell on the fields of battle.

The facts for this brief outline I have taken mostly from the published writings of Professor H. Lebert, who did heroic service at Berlin, Paris, Zurich, or Breslau, in every epidemic of cholera with which Europe has been visited. He has made a profound study of the history of this terrible disease.

From these facts, and some facts not here given, a few important conclusions may be drawn :

1. No law of periodicity in the recurrence of cholera epidemics can be made out. During half a

dozen decades, wave succeeded wave with only brief and irregular intervals.

2. Cholera has advanced in the lines of human travel, literally following the ebbing and flowing tides of men.

3. Cholera moves faster or slower, according to the pace of those whom it afflicts.

4. Its course is checked—only checked, not arrested—by cold weather. It has prevailed in England, even in frozen Russia, during the winter.

5. Elevation has an uncertain effect on cholera. It has prevailed on the slopes of the Himalayas, has overleaped the lofty barriers of the Caucasian Mountains, and has decimated cities in Mexico of greater altitude than the passes of the Alps.

Dr. C. Macnamara, who has had abundant experience of cholera in India, gives a graphic and accurate description of an attack of the disease in an able article on the subject in Quain's excellent "Dictionary of Medicine," recently published, from which I extract sufficient for my present purpose, condensing and freely translating all technical terms into plain English:

Asiatic cholera is most deadly at the commencement of an epidemic, and then usually begins without premonitory symptoms. The patient feels well up to within a few hours of the attack. As a rule, cholera commences with diarrhœa, the stools being copious and watery, followed by great prostration, with a peculiar feeling of exhaustion at the pit of the stomach; the sick person suffers from nausea, but seldom from

actual vomiting or pain at the outset of the attack. If judiciously treated, many patients recover from this, the first stage of cholera; but, if neglected, the tendency of the disease is to grow rapidly worse. The stools become more frequent, and resemble the water in which rice has been boiled; these liquid evacuations flow away with a sense of relief, but the patient now commences to vomit; the fluid is ejected from his mouth with considerable force, and this adds to the increasing prostration, which is one of the most urgent and marked features of the disease. The patient complains of intense thirst, and burning heat at the pit of the stomach; he suffers also excruciating pain from cramps in the muscles of the extremities; he is terribly restless; and his urgent cry is for water, and some one to rub his limbs. Although the temperature of the sick person falls below the normal, he complains of feeling hot. The pulse is rapid and weak, the breathing hurried, the voice husky, the countenance pinched, the skin doughy. The duration of this, the second stage of cholera, is very uncertain; it may last two or three hours, or twelve or fifteen; but so long as the pulse can be felt, there is hope. The weaker the pulse the nearer the patient is to the third or collapse stage, from which few recover. The chances depend upon the strength of the heart to some extent. In the third stage the vomiting and purging continue, but in a mitigated form; the patient can not speak above a whisper, the breathing is rapid, the eyes are deeply sunken, and the features marvelously changed; the temperature of the body

falls, the patient is restless, and longs only for sleep and water; his intellect is clear, but he seldom expresses any anxiety regarding worldly affairs, although fully conscious of the dangerous condition he is in.

All cases are not so severe. During an epidemic many have the cholera lightly, and are the more dangerous to the public from the fact that they are able to go about during convalescence. Some die within a few hours after the beginning of an attack. Of course, there are all degrees of intensity between the two extremes. Epidemics vary in violence. In some epidemics half the attacked die; in others, not more than one fifth.

LXVI.

It is extremely difficult to give a clear idea of the cause of cholera, or of many other epidemic diseases, to non-scientific readers. I can only hope to convey a somewhat vague and general notion of it, yet sufficient to make the way in which the disease is spread understood.

All around us, in air, earth, and water, are living things, vegetable and animal, too small to be seen by the unaided eye. They are invisible, in the ordinary sense of the word. The microscope has revealed much, but there is unquestionably an immeasurable realm of the "infinitely small" which no instruments can make known to us; yet the mind and the imagination can penetrate beyond the region of the senses. The

unseen plants and animals live and die, as the visible plants and animals live and die; only, their propagation, growth, maturity, and decay are rapid in proportion to their minuteness. In the little, as in the great, nothing grows but from seed. Where the seed comes from in the beginning no man knoweth. Each produces after its own kind. In the little, as in the great, animals live upon plants or upon one another; and plants live upon the decaying remains of animals or upon the rotting *débris* of other plants. Everywhere life and death are strangely intermingled. With every breath we draw we take into the lungs myriads of invisible animals and plants. Every swallow of water contains an ocean of living things, both from the animal and the vegetable kingdom. For the most part, these things are harmless, or we should all speedily die. Sometimes poisonous invisible plants or animals come and cause disease, each after its kind.

In our own times many diseases, before inexplicable, have been distinctly traced to their living causes. Within this century the common itch has been found to be the result of an insect, barely visible to a sharp eye, looking very like a mud-turtle under a magnifying-glass, which creeps from person to person and flourishes best in the midst of filth and negligence. Within the memory of the living the deadly little trichina-worm has been discovered with the aid of the microscope; its wonderful life-habits have been traced; eighty thousand of them have been counted by a patient German scientist in a single cubic inch of flesh. The minute plant causing the deadly splenic fever,

killing great numbers of domestic animals, as well as human beings, has been discovered quite recently, and the laws of its growth have been fully ascertained. M. Pasteur has studied all its habits, and Professor Tyndall has ascertained what degrees of heat will kill both the plant and its seeds. By the aid of powerful microscopes the minute plant that gets into the body of man and causes malarial fever has been discovered, and successful experiments have been made with it on the lower animals. The bacterium causing diphtheria, a low animal organism, so minute as to be on the very borders of the visible, has been recently studied out by very skilled microscopists both in Germany and in this country. Within a year or two Koch has startled the world by discovering and describing the minute organism that feeds upon the lungs of man and causes consumption.

But enough in the way of preliminary illustration. Professor Lebert, a very high authority, expresses the convictions of scientific Germany, in regard to the cause of cholera, as follows: "A cholera-germ must be accepted—in fact, it is now almost universally accepted—as the very probable cause of the disease. It is easy to understand that a minute, specific, and peculiar Indian parasite might develop its action wherever it is carried, when it finds favorable conditions for prolific reproduction." He thinks this minute vegetable parasite belongs to the protomycetes—the smallest microscopic single-celled plants. This minute parasite, originating only in India, flourishes in the stomach and intestines of man, when planted

there, and causes cholera. The poison, whether vegetable or animal, or something else, is contained in the discharges from the bowels of cholera-patients. Dr. Macnamara says: "Cholera-patients can not, in fact, communicate the affection to others, unless by the means of the discharges which they pass. Persons attending them run no risk of contracting the disease, provided they are protected from swallowing the organic poison passed by the sick; but, in badly ventilated rooms, this organic matter, having been disseminated in considerable quantities through the atmosphere, may be taken into the system by attendants, and so poison them." Dr. W. Aitken observes that the evidence in favor of the communicability of cholera by means of water or food contaminated with cholera-dejecta has, since 1854, become almost overwhelming. A volume from great authorities on this point might be cited.

The ways in which food and drink may become contaminated with the excreta of cholera-patients are numerous, and obvious enough to skilled investigators. The subject is far from being inviting, but it lies at the very core of any fruitful consideration of the diffusion of cholera. Correlatively the means of preventing the disease must be sought in the study of the problem how to escape planting its minute and disgusting germs in the stomach and bowels.

Let us go in imagination to the sick-room and closely observe the scene. The attendants on the patients are bewildered, perhaps terrified, by a sudden and dangerous and it may be fatal calamity.

They forget, quite likely don't know, that the copious rice-water excreta contain the seeds of cholera, so much to be dreaded. The patient is probably helpless. Bed-clothing and personal clothing are diffusively soiled. The hands of attendants are infected. Bread is broken and eaten with half-washed fingers. Remember, it takes but a microscopic particle to inoculate a susceptible person. Drinking-cups are handled, and the edges smeared, with dirty fingers—perhaps not visibly dirty, but we are considering a poison that can not be seen with the naked eye. The soiled clothing is piled in a dark closet, where the deadly germs are still further multiplied in the stagnant air and in the recesses of the infected fabrics. When the door is opened, the germ-laden air comes in contact with lips and throat, and the invisible poison is swallowed, to germinate in a deadly harvest through the stomach and intestines. Sometimes the atmosphere of the sick-chamber becomes so close and foul for the want of ventilation as to produce the same results on the inmates. The dirty linen is especially dangerous to those who wash it. Invisible spores, or germs, of the cholera-fungus rise to the face of the laundress. Pocket-handkerchiefs and towels become easily soiled in the sick-room and are unconsciously or forgetfully placed in contact with the lips. The contents of chamber-vessels used by patients are not unfrequently thrown out upon the ground, or into vaults, where, under favoring conditions, the germs are multiplied and may find their way through the veins of the earth into wells of

drinking-water, tens of feet, perhaps hundreds of feet away, thence to be conveyed to the stomachs and intestines of many unsuspecting people.

Drinking-water, polluted in some such way, is the most fertile source of cholera. In India, foul pilgrims defecate, bathe, wash their clothes in and drink from the same pool. In many Christian cities, sewage empties into the same stream from which the water-supply is taken. All over our own enlightened land we find the privy and the well in dangerous proximity. The milkman perhaps washes his utensils, or even dilutes his milk, with infected water, and distributes the death-laden liquid to whole neighborhoods. The excreta thrown upon the ground perhaps dry up, and the germs are blown to the lips of people in the distance.

There is abundant, perhaps even demonstrative, objective evidence of the preponderating influence of polluted drinking-water in the dissemination of cholera. "In 1854," says Dr. Parkes, "occurred the celebrated instance of the Broad Street pump in London, which was investigated by a committee, whose report, drawn up by John Marshall, of University College, with great logical power, contains the most convincing evidence that, in that instance, at any rate, the poison of cholera found its way into the body through the drinking-water." In Scotland, Dr. Stevenson Macadam has published very striking coincidences between the abatement of the disease and the introduction of a fresh and pure supply of water. In the city of Rotterdam, during an epidemic of chol-

era, the introduction of pure water immediately reduced the mortality to one half. Dr. Aucland relates, as quoted by Dr. Parkes, that two jails were near each other: the one suffered, the other did not; the water was impure in one case from drainage, pure in the other. The jail with bad water having got a fresh supply, the cholera did not appear in the next epidemic. In Haarlem, Holland, cholera prevailed with great intensity in 1849. In 1866 it returned, and again prevailed as severely in all parts of the town, except one. The part entirely exempted in the second epidemic was inhabited by bleachers, who, between 1849 and 1866, had obtained a fresh source of pure water. Professor Foerster has shown that five towns of Silesia (of five thousand to twelve thousand inhabitants) are entirely free from cholera, which never spreads, even when introduced. The only common condition is a water-supply from a distance which can not be contaminated. In Glogau half the water is from a distance and half from wells: those using the former remain free; those using the latter are attacked. Dantzic and Königsberg formerly suffered equally: Dantzic, having a new water-supply, does not suffer; Königsberg, with its original supply, continues to suffer. In Berlin, in 1866, cholera prevailed much more in the houses supplied with bad water than in houses supplied with good water. Even in India the introduction of better water, in Calcutta and other cities, has greatly diminished the disease. Dr. Parkes again says that the prevalence of cholera in Russia, with a temperature

below zero, has always seemed extraordinary, and it appeared only possible to explain it by supposing that in the houses the foul air and the artificial temperature must have given the poison its necessary conditions of development. But Dr. Routh has pointed out that, in the poorer Russian houses, everything is thrown out round the dwellings; then, owing to the cold, and the expense of bringing water from a distance, the inhabitants take the snow near their houses and melt it. It is thus easy to conceive that, if cholera excreta are thrown out, they may be again taken into the body. This is all the more likely, as cholera emanations have little smell or taste, and, when mixed even in large quantity with water, are indetectable by the senses.

Great Britain, with her Indian colonies, has had unequaled experience of cholera. Reports of special commissions have accumulated an overwhelming mass of facts in favor of the views here presented.

LXVII.

The prevention of cholera is already indicated in the explanation of its cause, and in the description of the ways in which it is diffused. Extreme cleanliness on the part of attendants is of the utmost importance. The hands should be thoroughly washed as often as soiled, and the water in which they are washed should not be left for another to use. Towels on which the hands are wiped should never be put to the face; a microscopic particle of

infection might be planted on the mucous surface of the lip. Dishes and drinking-cups used by the patients should be used by no one else, and when removed from the room should be immediately washed in boiling water. Any food tasted by the patient should be burned without delay. Beware of wiping the face with pocket-handkerchiefs and napkins that have been held with soiled fingers. The sick-room should be well ventilated, so as to prevent multiplication of germs in the stagnant air. The body and bed-linen of the patient, as soon as soiled, should be put in water containing some strong disinfectant. Twelve gallons—four pailfuls—of water in a tub, in which have been dissolved two pounds of sulphate of zinc and three ounces of carbolic acid make a good receptacle for such a purpose. Let the clothes stand in soak for several hours, and then boil and wash them. Soiled mattresses that can not be boiled and washed should be burned. A pail of water in which have been dissolved half a pound of sulphate of zinc and an ounce of carbolic acid should be at hand, and some of it should be poured into chamber-vessels every time they are used. If there is nothing else at hand, use strong vinegar for such a purpose. The doctor will direct you as to other disinfectants. If the contents of chamber-vessels should be thrown into a privy-vault, or on the ground, without disinfection, make haste to cover the same with fresh lime, chloride of lime, strong solution of copperas, or some other destroyer of germs. Carbolic acid, to be effective, must be used in pretty large quantities. A solution of cor-

rosive sublimate is very potent for disinfection, but it is a dangerous poison to have about. The same is true of nitric, sulphuric, and hydrochloric acids.

If such exhaustive pains could be taken in the care of individual cases, cholera would not spread to any great extent. It is the light cases of cholera, however, that most disseminate the disease. After a brief attack, not dangerous to themselves, patients go about while the stools still contain the poisonous germs which are not at all cared for, and become very dangerous to others. So important is this fact, and so well is it understood in England, that when some patients, with a slight attack, escaped from an infected ship at a southern port and journeyed by railroad to Liverpool, sanitary officers followed and disinfected water-closets at every station where it was possible for them to stop, thereby averting the spread of the disease. During the prevalence of cholera, all water-closets on steamboats and at railroad depots should be thoroughly disinfected every day. The germs of the disease multiply in the filth of such places, and may infect a mucous surface in those who are obliged to frequent them.

As in most places there is no provision of law for the inspection of dairies outside of the jurisdiction of health-officers, it is very important that the people should know how to protect themselves against possible contagion from milk. Boiling will kill any germs that may find their way into milk from the soiled fingers of those who handle it, or from infected water used to adulterate it, or to wash the cans in which

it is carried. Cooked cholera, like cooked small-pox, is harmless. Boiling milk before it is used would doubtless prevent some mysterious cases of diphtheria, scarlet fever, and typhoid fever. The boiling of milk would probably also save some children who die of cholera infantum.

Drinking-water is of the greatest importance. In many towns the water-supply is liable to pollution. The only way to escape danger during the prevalence of cholera is to boil the water before using it. Boiled water is not pleasant to the taste, but a weak infusion of tea will make it palatable. Ice will improve it; but look out for ice cut on questionable ponds and inlets, or below sewers in a winter following a cholera season. The spores, or seeds of the cholera fungus, may stand any amount of cold, while a boiling-heat speedily kills them. Seed-corn will never germinate after boiling, but a cold of forty degrees below zero does not hurt it.

No amount of filth will create cholera, but it furnishes the conditions for its spread. Want, squalor, negligence, unclean habits, will not start it anew, but the disease flourishes amid such surroundings. If a soil be ever so rich, it will not grow a crop unless the seed is sown. The sowing of seed will not produce a crop unless the soil is good. In combating cholera, as in combating other epidemic diseases, we must always do two things—we must, if possible, prevent the sowing of the seed, and must also make the soil unsuited to its growth. Cleanliness and the prevention of the diffusion of the noxious germs are of equal importance.

All authorities are agreed that it is of vital importance to promptly attend to the usual preliminary diarrhœa during the prevalence of cholera. In British India it is a standing military order that any soldier going more than once a day to the latrine shall immediately report to the medical headquarters. Then is the precious time for treatment. If cholera is about, every one should go to his physician and procure a medicine for this premonitory condition, always to be carried about with him.

Beware of quacks and the advertisers of cholera-cures; your trusted family physician is the one to consult, and his advice will be safest to follow. Any essential changes of diet are more harmful than beneficial. Unripe or decaying fruits and vegetables should be carefully avoided. Temperance in all things is best. Drunkards, gluttons, and debauchees are among the earliest victims of cholera.*

LXVIII.

Scarlet fever, scarlatina, scarlet rash, canker rash, rash fever (all different names for the same disease), is not especially contagious at the outset of an attack, although it becomes so after the first day or two, and, therefore, when it is early recognized, opportunity is afforded to take precautions against its spread. When patients are cared for at home, as they generally

* For a pretty full account and estimate of Professor Koch's recent investigations, see Appendix.

must be, the following rules, published some time ago by the British Society of Medical Officers of Health, and followed by careful and intelligent people in England, are excellent, and will save a great deal of suffering and sorrow if strictly observed :

"1. Separate the sick person from the rest of the family directly illness appears, placing him, if possible, in a room at the top of the house, and taking care to remove carpets, curtains, and all unnecessary articles of furniture and clothing therefrom.

"2. Admit fresh air by opening the upper sash of the window. The fireplace should be kept open, and a fire lighted if the weather permits. Fresh air should be freely admitted through the whole house by means of open windows and doors. The more air that passes through the house, the less likely is the disease to spread.

"3. Hang up a sheet outside the door of the sick-room, and keep it wet with a mixture made either with a quarter of a pint of carbolic acid, or a pound of chloride of lime, and a gallon of water.

"4. Everything that passes from the sick person should be received into vessels containing half a pint of a solution of green copperas, made by dissolving one pound of the copperas in a gallon of water. A like quantity of the solution of copperas should be added to the discharges before emptying them into the closet.

"5. Every sink, closet, or privy should have a quantity of one of the above-named disinfectants poured into it daily, and the greatest care should be

taken to prevent the contamination of well or drinking water by any discharges from the sick person.

"6. All cups, glasses, spoons, etc., used by the sick person should be first washed in the above-named solution of carbolic acid, and afterward in hot water, before being used by any other person.

"7. No article of food should be allowed to remain in the sick-room. No food or drink that the sick person has tasted, or that has been in the sick-room, should be given to any one else.

"8. All bed and body linen, as soon as removed from the sick person, and before being taken from the room, should be first put in a solution of carbolic acid of the above-mentioned strength, remaining therein for at least an hour, and afterward boiled in water.

"9. Instead of handkerchiefs, small pieces of rag should be used, and these, when soiled, should be immediately burned.

"10. Persons attending on the sick should not wear woolen garments, as they are likely to retain infectious poison; dresses of cotton, or of some washable material, should be worn. Nurses should always wash their hands immediately after attending to the sick person, using carbolic-acid soap instead of ordinary soap.

"11. It is of the utmost importance that the sick-room be not frequented by others than those in immediate attendance on the sick, as the clothing of visitors is very liable to carry away infection.

"12. The scales and dusty powder which peel

from the skin in scarlet fever, and the crusts in small-pox, being highly infectious, their escape may be prevented by smearing the body of the sick person all over every day with camphorated oil. This, and the after-use of warm baths and carbolic-acid soap, are most essential. The sick person must not be allowed to mix with the rest of the family until the peeling has entirely ceased, and the skin is perfectly smooth; clothes used during the time of illness, or in any way exposed to infection, must not be worn again until they have been properly disinfected.

"13. When the sickness has terminated, the sick-room and its contents should be disinfected and cleaned. This should be done in the following manner: Spread out and hang upon lines all articles of clothing and bedding; well close the fireplace, windows, and all openings; then take a quarter to half a pound of brimstone, broken into small pieces, put them into an iron dish, supported over a pail of water, and set fire to the brimstone, by putting some live coals upon it. Close the door, and stop all crevices, and allow the room to remain shut up for twenty-four hours. The room should then be freely ventilated by opening the doors and windows, the ceiling should be whitewashed, the paper stripped from the walls and burned, and the furniture and all wood and painted work be well washed with soap and water containing a little chloride of lime. Beds, mattresses, and articles which can not well be washed, should, if possible, be submitted to the action of heat in a disinfecting chamber. Until this process of dis-

infection is effectually carried out, the room can not be safely occupied.

"14. Children should not be allowed to attend school from a house in which there is infectious disease, as, although not ill themselves, they are very likely to carry the infection, and so spread the disease. No child should be allowed to re-enter a school without a certificate from the medical attendant, stating that he can do so without any danger of infecting other children.

"15. In case of death, the body should not be removed from the room, except for burial, unless taken to a mortuary, nor should any article be taken from it until disinfected as before directed in rule No. 13. The body should be put into a coffin as soon as possible, with a pound or two of carbolic powder. The coffin should be fastened down, and the body buried without any delay."

The methods of disinfecting recommended in the preceding rules may be varied in accordance with instructions given elsewhere in this book. Scarlet fever requires fully as much care and caution as small-pox.

LXIX.

The cavities of the face, neck, and head * are continuously lined with mucous membrane, which is extensive enough, if it were dissected out, to form an ample night-cap. On this mucous membrane diph-

* The mouth, pharynx, larynx, trachea, bronchi, Eustachian tubes, inner ears, cells of the mastoid processes of the occipital

theria manifests itself, as small-pox manifests itself on the skin. The disease rarely invades all these cavities; its favorite seat is the throat, or fauces. Sometimes it also shows itself on other mucous surfaces, even on abraded patches of the skin.

Diphtheria is a good deal older than its name. Hippocrates, Celsus, Galen, Sydenham, and many others, have described it clearly enough, but it was reserved for Bretonneau, of Tours, to differentiate it and to give to it a distinct title and place in medical literature. In 1826 Bretonneau published his "Récherches, etc., sur la Diphthérite." In 1855 he published his latest memoir, in which the term *diphthérie* is substituted for *diphthérite*. In 1859 the Sydenham Society of London published a volume on the subject of "Diphtheria," translated from the French of Bretonneau and others. Previous to that, the term was unknown in English medical literature.

Eminent German pathologists and microscopists—Oertel, Hueter, von Recklinghausen, Waldeger, Klebs, Eberth, Heiberg, Virchow, Massiloff, Trendelenberg, Tommassi-Crudeli, Cohn, and others—have for some years regarded the disease as the result of a living organism, a *bacterium termo*. On the other hand, many British histologists question the conclusions of their German brethren. Whether the bacterium is the cause, product, or concomitant of diphtheria, does not seem to be settled.*

bone, nares, lachrymal ducts, antrum of Highmore and the passages leading thereto, conjunctiva, and frontal sinus.

* Wood and Formad, in this country, competent observers, in-

Several thousand cases of diphtheria have come under my sanitary supervision in the administration of municipal regulations for the control of infectious diseases, affording me abundant opportunity for investigating it, not pathologically, not therapeutically, but in its hygienic relations. My official sanitary service has been in two large cities, the laws of which require physicians and householders to report to the health department all cases of contagious diseases. By the aid of competent inspectors I have investigated the sanitary condition of every house in which diphtheria has been reported, with especial reference to site, plumbing, drainage, connection with sewers, etc. My

vestigated diphtheria under the direction of the National Board of Health, and came to the following general conclusions:

"1. The micrococci of diphtheria do not differ, so far as observed, from those of furred tongue, etc., except in their tendency to growth in culture-fluids.

"2. The micrococci of furred tongue, or ordinary sore throat, have a less tendency to grow under culture than have the micrococci of endemic, non-malignant diphtheria.

"3. The micrococci of endemic or non-malignant diphtheria have a much less tendency to grow under culture than have the micrococci of malignant diphtheria.

"4. The rapidity of growth of the micrococci is in direct proportion to the malignancy of the case yielding them, and its contagiousness.

"5. On exposure to the air, diphtheritic membrane of the most virulent type loses its contagious power, and the micrococci *pari passu* lose their power of growing in culture-fluids.

"6. Under successive generations of artificial culture, the diphtheritic micrococci lose their growth and activity, and also their power of infecting the rabbit.

"7. It has not been experimentally directly proved, but it is a

large experience has given me a very strong conviction of the following facts :

1. The gaseous emanations of filth, of organic matter in process of putrefaction, is the very breath of life to diphtheria. It loves broken drains, untrapped waste-pipes, unventilated soil-pipes, manure-heaps, and foul sewers. It delights in a habitation built on a site filled in with street-cleanings. Basements flooded with sewage charm the fiend. The smell of rotten vegetables in the cellar it construes into an invitation to call and make itself at home. Excrement-sodden soil and polluted drinking-water make it happy.

2. Diphtheria is contagious and infectious. Food tasted by the sick, the air of an unventilated chamber, drinking-cups, towels, pocket-handkerchiefs, anything that will convey the subtile poison from the diseased mucous membrane of the patient to the mu-

necessary inference from the two facts just stated, that under certain favoring circumstances the sluggish micrococci take on growth-activity, and in all probability poisonous properties.

"8. Every grade of case can be found in man, from an ordinary, sore throat, through simple pseudo-membranous angina and trachitis, up to malignant diphtheria.

"9. Any inflammation of the trachea of sufficient intensity may cause the formation of a pseudo-membrane.

"10. A case may begin as one of sthenic 'pseudo-membranous croup,' and end as one of adynamic 'diphtheria,' with blood-poisoning; and in cases of this character not unfrequently no exposure to contagion is discoverable, and there is clinically every reason to believe that the blood-poison has been developed within the body of the patient."

cous membrane of persons in the vicinity, will communicate the distemper. Many a child is killed with a diphtheritic kiss.

3. As a rule, people will have small-pox, scarlet fever, measles, and many other infectious diseases, but once. Diphtheria is an outlaw, and repeats itself as often as it gets a chance.

4. Nursing children and old people are not apt to have diphtheria, but may have it. Mature women take their nurslings with them to see a diphtheria patient or corpse, and are ready to swear that the disease is not "catching," because neither they nor their babies have been infected.

5. So-called membranous croup, except when traumatic, is identical with diphtheria. Some doctors still call diphtheria membranous croup, when it affects the larynx and trachea, and is not visible in the throat. Terrible mischief may be done when the wrong name leads to the supposition that the case is not contagious. Death frequently steps in to break the dangerous obstinacy of practitioners and people on this point.

6. Sore throats are as dangerous as Egyptian sore eyes. They may contain a contagious diphtheritic element, especially when diphtheria is epidemic. Some physicians tell the people that all cases of real diphtheria terminate in death. The inference is that cases which get well are not diphtheria at all. Such physicians are fools or knaves—fools, if they don't know any better; knaves, if they are attempting to disarm precaution for the purpose of increasing trade.

The mortality of diphtheria averages about forty per cent, the same as that of small-pox.

7. Diphtheria, which is now the most continuously murderous contagious disease afflicting the civilized portions of mankind, can not be eradicated till communities and people eliminate filth, or, in other words, till all organic wastes are removed from inhabited places before the process of putrefaction evolves the gases that feed it, perhaps create it. Isolation and disinfection can materially check its career, but can not entirely stop it, while cesspools, vaults, polluted drains, foul sewers, and areas of soil contaminated with stagnant water and animal excreta, continue to distill their poisons into the air which we breathe and into the water which we drink.

People sometimes ask why, if these things are so, diphtheria prevails in the open country not less than in cities. It flourishes in the country for the simple reason that the drinking-water of the farm-house is often furnished by the well into which seeps the drainage of a foul vault or rotten barn-yard, and the inmates of the farm-house breathe air reeking with putrescent slops ponded about the kitchen-door. The habitations of the country, as a rule, are in worse sanitary condition than those of cities.

The rules to be observed in the care of scarlet-fever patients should also be observed in the care of those afflicted with diphtheria. It is not necessary to repeat details previously given.

LXX.

Typhus fever is much rarer in this country than formerly. In crowded and unventilated quarters it feeds on air poisoned with the putrefactive exhalations of the human skin. It is held possible by some that it may originate *de novo* from such a source. It is a highly contagious fever, and requires precisely the same care as scarlet fever. Wash it out, if possible, by letting into its haunts an ocean of fresh air.

LXXI.

Genuine enteric or typhoid fever is diffused in the same way as cholera, and requires the same care. Bilious fever, springing from malaria, and modified in type by conditions of filth, is often called typhoid fever. It is really an enteroid fever. Many have called it typho-malarial fever. It is probably not infectious, but it is far better to use too much rather than too little precaution with it. The conditions of enteroid fever are always favorable to the spread of typhoid or enteric fever, when the seed is once sown. It is not certain that real enteric fever may not start *de novo* by drinking water or breathing air impregnated with particles of putrefactive excreta. Cleanliness is the best means of combating even typho-malarial or enteroid fever, which is frequently very destructive.

LXXII.

The vast literature of yellow fever is in a state of great confusion and perplexing contradiction, owing, in my judgment, to the confounding of certain icteroid forms of malarial fever with true yellow fever. The word fever is unfortunate, here as well as elsewhere, inasmuch as it expresses a morbid condition of many diseases, instead of a disease itself. The icteroid forms of malarial fever are climatic, not contagious, and are influenced by specific treatment. True yellow fever is not the product of climate, although dependent on climate for the conditions of its growth, prevalence, and intensity; is contagious, and is not even modified by any known treatment.

In a few sentences I will give the conclusions of some eminent physicians who have had experience with yellow fever, but would suggest that readers do not lose sight of the distinction made in the previous paragraph.

Yellow fever is rarely found south of the twentieth degree of latitude, or north of the fortieth, at this end of the globe. It is much more common in the Western Hemisphere than in the Eastern. It is more common in Europe than in Africa. It is almost always confined to commercial seaports and to towns on the banks of navigable rivers. In sections of the country where it prevails it is usually confined within circumscribed limits. In the Eastern Hemisphere it visits most frequently the Mediterranean ports of Spain. In America the seaports of the Gulf of

Mexico are its favorite seats. It frequents the Atlantic ports from Charleston southward, yet it has often visited ports as far north as New York. New Orleans is a favorite haunt of yellow fever, and it often visits Natchez, Vicksburg, Memphis, and other river towns on the lower Mississippi. Probably the habitat, or native place, of yellow fever is on shipboard. There it usually breaks out while the ship is in port. Sometimes it breaks out in a ship at sea. In 1799 the frigate General Greene sailed from Newport, Rhode Island, for Havana, and yellow fever broke out before she reached port. Dr. La Roche, who has written the most exhaustive treatise on the subject, shows, as I think conclusively, that the origin of yellow fever is on shipboard, without the operation of external agencies; but he goes too far in saying, without "the introduction of contagious germs." Dr. Wilson, a very high authority, says that, at the beginning, the disease is confined to a small space on shipboard, usually the center, where the bilge-water settles. It is a curious thing, often observed, that yellow fever is usually confined to certain well-defined quarters or neighborhoods in cities where it prevails. Dr. Nott, of Mobile, says: "I have on two occasions seen yellow fever commence in a point in a town, and eat through it, square by square, like worms in a cotton-field, taking each time nearly a month for the process." M. Berthe, one of the French commission to investigate the epidemic in Andalusia in 1800, says: "It was distinctly observed that the malady seized all the houses situated on the same side of the street, and

rarely passed over to the other side, where streets were wide and well aired."

The disease is almost always most prevalent in July and August, but sometimes extends through September, October, and even November. In 1793 a severe epidemic visited Philadelphia, which lasted till the middle of October. A great epidemic visited New York in 1798, which lasted till the middle of November. The deaths were over two thousand. In New York, between six and seven hundred died of yellow fever in 1803. Three hundred died of it in 1805. In the same city there were one hundred and sixty-six deaths in 1822. It is a curious fact that in New York, in 1800, it continued ten days or more after the first frost. But, as Dr. Walters says, the out-door poison was killed by the frost, but the infection remained in the houses. Dr. La Roche gives an analysis of fifteen epidemics in which the mortality was greatest in October. In Philadelphia, in 1820, it lingered till the last of November. As they say in the South, it requires a black frost to kill it. The most reliable observers of yellow fever have come to the conclusion that its prevalence does not depend upon the heat of the season. The New Orleans Board of Health say: "The disease has been known to prevail here alike in dry or wet seasons, and without regard to the variations of temperature in the summer months."

There are many curious facts in regard to the disease. As a rule, people will not have it twice. Men are more susceptible to the disease than women. In

an epidemic which desolated the Island of Barbadoes, for one woman that died there were ten men. In the great Spanish epidemic of 1804, the aggregate mortality in twenty-three towns was 45,322 ; the male deaths amounting to 28,852, the female to 17,470. In Charleston, South Carolina, from 1817 to 1839, there were 976 deaths of males and 178 of females. As a rule, negroes have yellow fever much more lightly than Caucasians. Yellow fever is more liable to attack plethoric and stout people than the delicate and feeble. Several first-class authorities have observed that persons suffering with syphilitic disease are especially liable to it. In yellow-fever regions the natives are much more exempt than the unacclimated.

Dr. Greeneville Dowell, in his treatise on yellow fever and malarial diseases, expresses the views of many when he says: "Yellow fever can not be taken, in pure air, from persons, clothing, trunks, or black-vomit; but in an impure air, other things being suitable, it can be taken from either." From his investigation into the conditions and causes of yellow fever in the United States, with the help of the library of the surgeon-general at Washington, and a personal experience of over two thousand cases, he concludes that nothing is so important in the prevention of yellow fever as proper water-supply and sewerage. More than one tenth of the inhabitants of Buenos Ayres died of yellow fever in 1871. As the epidemic was traced largely to filth, an English engineer was employed to carry out a complete system of sewerage and water-supply. A subsequent sanitary report

emanating from that city says: "The works of drainage and sewerage so actively prosecuted at the present time are destined to radically remove this infection, which experience has demonstrated to be one of the most fruitful causes of disease and death." While the Federal troops were in possession of New Orleans, during the late "unpleasantness," the commanding general required the city to be cleaned up; the result of which was the banishment of yellow fever for the time being. Not that General Butler and the medical men on his staff knew more about yellow fever and sanitary science than the existing Board of Health of New Orleans; but under martial law, with a great army at command, certain things can be easily done which municipal governments utterly fail to carry into effect. Fools in every community resist, actively or passively, the execution of sanitary law, and nothing less stringent than military despotism can overcome the resistance.

The following conclusions were reached by the Yellow Fever Commission in a report presented to the American Public Health Association, at Richmond, on the 20th of November, 1878, after investigating the sad but instructive epidemic of that season:

"1. We have not in a solitary instance found a case of yellow fever which we could justifiably consider as of *de novo* origin, indigenous to the locality.

"2. In respect to most of the various towns which we visited and which were points of epidemic prevalence, the testimony showing the importation was direct and convincing in its character.

"3. The transmission of yellow fever between points separated by any considerable distances appeared to be wholly due to human intercourse. In some instances the poison was carried in clothing, or about people going into infected districts. In others it was conveyed in cotton bagging, or other goods of the same description.

"4. The weight of testimony is very pronounced against further use of disinfectants. Physicians in infected towns, almost without exception, state that they are useless agents to arrest the spread of yellow fever, while some of them affirm that their vapors are seriously prejudicial to the sick.*

"5. Personal prophylaxis, by means of drugs or other therapeutic means, has proved a constant failure. A respectable number of physicians think the use of small doses of quinine of some use in the prevention.

"6. The quarantines, established with such a degree of surveillance and rigor that absolute non-intercourse is the result, have effectually and without exception protected its subjects from yellow fever."

I have no doubt that the source of the disease, the real contagion, is a microscopic organism which flourishes about shipping in the ports of hot climates, but will not germinate in this region. To borrow an

*The Association did not indorse this conclusion of the commission. Ramon da Luna used fumigations of nitrous acid, and European authorities assert that no other agent is so effective in preventing the spread of the disease ("Annales d'Hygiène," April, 1861).

idea, and in part the words, of Dr. William Roberts, in his address before the British Medical Association, 1877, the yellow-fever virus may be an occasional "sport" of some West Indian saprophyte, which by variation has acquired a parasitic habit, and having run through countless generations either dies out or reverts again to its original type. When the variation occurs, yellow fever becomes epidemic; when it dies out, or reverts to its original type, yellow fever disappears.

There is evidence that clean towns, even in the South, were exempt from the epidemic of 1878. The Charleston (South Carolina) delegates to the Public Health Association, in a report to the Board of Health of their own city, after their return from Richmond, made the following very important statement: "That there were local sanitary conditions or climatic influences, which in certain instances afforded immunity from an epidemic, was made apparent, not by the commission, but from facts presented by individual members of the profession who were present representing towns located in the midst of the infected region. The town of Huntsville, Alabama, containing five thousand inhabitants, afforded a striking illustration of this fact. Its doors were open to refugees from Memphis and other stricken cities; quarantine was entirely disregarded; the refugees entered with their trunks, bedding, and other effects. Out of the number of refugees twenty-four sickened with the disease after their arrival. These were quartered in different portions of the town; no effort was made to

isolate them, and yet not a single one of the people of Huntsville suffered in consequence. It was ascertained that this town had some years since suffered from epidemic cholera. At that time great energy had been manifested, the place was put in thorough sanitary condition, and has been so kept ever since. No other explanation can be afforded of Huntsville's escape from pestilence."

LXXIII.

There are degrees in murder. He who assaults a strong man and slays him may be entitled to some credit for courage. A weak woman may ward off a blow, and can cry out for help. The piercing shriek of the aged may reach the sympathetic ear of some mortal who may render aid. A child, whose hand is weak, may utter a sob or moan that will appeal to the humanity of all within hearing distance. But he who kills a helpless infant in its mother's womb commits the wickedest of all murders. The little thing has no power to resist. It can not even sob, or moan, or cry. The very circumstances of its murder indicate premeditation and dastardly cowardice. The mother, near whose heart it nestles, must necessarily be an accomplice. It may be that her soul has been debauched by the slayer; it may be that she herself is a deliberate murderess.

Day by day we are appalled at the record of crime. Let it not be forgotten that the most important, the most vital, the most abiding education any human

being gets he receives before birth. Every thought, every emotion, every impulse of the mother during gestation is stamped into the plastic nature of the unborn child. Many a woman who lacks the skill, the courage, or the money to hire a medical assassin, wishes and meditates upon the death of the babe that she carries in her womb. Thus the poor thing is already educated to murder when it is born. In no other way can I account for certain sudden outbreaks of homicidal or suicidal impulse in people who are apparently sane. It is an awful thing to come unbidden into the world with a fatal taint of parental total depravity.

LXXIV.

The State, upon the legitimate ground of public economy and self-preservation, takes charge of the primary education of the people. It therefore determines what secular knowledge shall be taught in the common schools. It may, and properly should, add the simple and ascertained laws of health and public hygiene to reading, writing, grammar, geography, arithmetic, and history of the country. It is more important to children to learn that water from the school-house well, only a few feet from the privy, is quite as dangerous to them as a mad dog lurking in the neighborhood, or that foul air in the unventilated school-room is likely to cause their poor mothers watchful nights, and may bring dreaded and costly visitations of the doctor, as it is to learn to cipher, parse,

name the rivers of Africa, or bound an unknown state with unpronounceable name in the center of Asia. It touches a good father's pride and makes his dear wife happy, to know that their children are improving at school; but health is the incomparable blessing of the household, and is more highly prized than learning. Give the citizen a plain and sensible reason for such teaching, and not a mere professional and mysterious order, and he will not only co-operate with the State, but grow more thankful for the enlightened government under which he lives. Hence it is profoundly true that we must depend upon the governing agency, upon the enactment of wise law and its prudent administration, for anything like a general diffusion of sanitary knowledge. It is a disgrace to our higher institutions of learning that they are still neglecting sanitary science. It is a sad sight to see the young men and the young women from the first American families, at colleges and seminaries, surrounded with costly appliances for learning all the sciences under the sun but the one science that reveals to them how to avoid breathing, drinking, even eating their own excreta!

LXXV.

Nothing so closely concerns political economy, or the material welfare of a nation, as the proper sanitation of the people. It would not be difficult under properly co-ordinated and efficiently administered national and State sanitary codes to lessen the mortality

of the people by at least four in the thousand. on our population of fifty millions there are more than one million of deaths every year. At least two hundred thousand of these deaths are preventable by sanitation. To turn our eyes from sickness and sorrow, from the great sea of heart-ache among the people, and to look coldly on the ledger of public prosperity, we find that these two hundred thousand preventable deaths mean a vast sum of money. For every death there are more than twenty cases of sickness. The doctor, the apothecary, the undertaker, and grave-digger, cost hard cash. The productive industry of a sick member of the community ceases during illness. The fruitful toil of the dead ceases forever. Skilled and reliable workers in statistics cipher out for us that each death from preventable disease means, directly and indirectly, in the ways here indicated, a loss of one thousand dollars. The two hundred thousand preventable deaths in the nation every year represent an annual public loss of two hundred million dollars. Ten per cent of such annual loss would defray the expense of carrying out in minute administrative detail a complete system of sanitation for the whole country. Instead of exaggerating, I purposely make estimates that none can dispute.

LXXVI.

It is time for the translation of sanitary science into law. This is a new and fertile field for great and enlightened statesmen. The people quickly

learn to appreciate what really brings them good. The one guiding principle in such a transition is, that only the undisputed conclusions of sanitary science, not sanitary theories, should be enacted in a clear code, with simple, easily comprehensible, just, impartial, and economic modes of administration. Cleanliness and healthfulness impose few burdens, and enhance the value of everything which they touch. As Dr. Richardson beautifully says: "A change has come over the science of medicine; with nobleness of purpose, true Medicine has been the first to strip herself of all mere pretenses to cure, and has stood boldly forth to declare, as a higher philosophy, the prevention of disease. The doctrine of absolute faith in the principle of prevention includes the existence of a higher order of thought, of broad views on life and health, on diseases and their external origin, of death and its correct place in nature."

LXXVII.

Owing to the peculiar and complex form of our government, sanitary law must be dual in form and administration while maintaining unity of purpose. In other words, we must have a national code and State codes. The aim of both will be to increase the power and prosperity of the people by enforcing regulations to protect them from preventable causes of sickness and death. We have a few very good municipal sanitary codes, but the statutes of States and of the United States contain a very limited number

of enactments designed to protect the public health. We are far behind Great Britain in this respect, where special acts of Parliament, for the last quarter of a century, have elevated the conclusions of sanitary science into the realm of law. The British people are already reaping therefrom a rich harvest of practical benefit.

LXXVIII.

Maritime quarantine ought to be in the hands of the Federal Government. There is no constitutional reason why the United States should not establish maritime quarantine wherever custom-houses are established. Quarantine of any port of entry touches the sanitary interests of the whole country. For example, Boston is not a port of Massachusetts alone, but of the whole United States. New Orleans is a port of the entire country, and not of Louisiana alone. Every port at which an infected ship may arrive belongs to the nation. It may not be constitutional for the General Government to say to a State that it shall not have a quarantine system, but the General Government has a right to establish its own quarantine at any point which is in maritime relation with the country at large and with foreign nations.

LXXIX.

An interstate quarantine system could at first be only tentative. It would necessarily have to be the

growth of time and experience—in other words, it would finally be shaped, to a great extent, by conflicts of State and national laws. The highest judicial tribunal would settle such conflicts, and make a practical system a beneficent reality. The power is clearly conveyed in the Constitution to regulate, restrain, or prohibit the movement of infected persons and the transportation of infected merchandise from State to State. Congress has already exercised this power by the act of March 3, 1873, "to prevent cruelty to animals while in transit by railroad or other means of transportation, within the United States." Still more reasonably may Congress exercise this power to protect the life and health of the people. If the Federal Government can interfere to prevent cruelty to animals, it certainly can interfere to prevent transportation of infected animals. If it can interfere to prevent suffering to a steer, it can interfere to prevent death to a man.

LXXX.

Every vessel carrying the American flag should be under the sanitary supervision of the General Government. Merchant-ships should be required to conform to proper regulations for preserving the health of sailors and passengers. Questions of food, ventilation, cleanliness, etc., are just as vital on the water as on the land. The Federal Government alone has power to enforce sanitary regulations on board ships which are registered and sail under its authority. Seamen and travelers have a right to be protected, in health

and life, against ignorance, negligence, and avarice, by the nation under whose flag they commit themselves to vessels sailing on rivers, lakes, and oceans. Frequent inspection by officers empowered to enforce sanitary regulations can alone secure such a desirable end.

LXXXI.

It is a conceded and well-known fact that various articles of manufacture, in common use among the people, are adulterated in such a way as to make the same dangerous to health and life. Poisonous dyes are used to color fabrics worn for clothing. Arsenical and lead pigments are wickedly employed to make candies look attractive to children. Canned fruits and meats are poisoned by lead. Sugars are poisoned by muriate of tin used in the process of refining. Wall-papers and toys are not unfrequently colored with compounds of arsenic. Dangerous drugs are used in the manufacture of beers, and in the "doctoring" of wines. But it is not necessary to multiply examples.

With the question of dangerous adulterations of various articles of commerce, local health authorities are unable to deal in an efficient and comprehensive way. Retail tradesmen are for the most part innocent or helpless. The manufacturers are generally to blame. They might be reached directly by State authority; but Legislatures are reluctant to enact laws that would only drive industries to other jurisdictions which may be more negligent and apathetic. Indi-

viduals, beset by universal evils, are quite helpless. It requires the power of a nation to cope with a danger of such magnitude.

The General Government, by exercising its constitutional authority to regulate commerce, can prohibit the importation, the exportation, and the interstate transportation of all articles which jeopardize the life and health of the people. If such articles were made by act of Congress liable to seizure *in transitu*, to confiscation and destruction, they would soon cease to be manufactured and would disappear from commerce. The consignor, the carrier, and the consignee of such goods should be penally responsible when proved to have criminal knowledge of their character. It might not be possible for the National Government to reach the manufacturer located within the jurisdiction of a State, but it could prevent him from extending his murderous trade to the country at large. A single seizure of his poisoned goods as soon as they crossed a State line and came under the jurisdiction of the national authority, would advertise his nefarious business to its death. No foreign manufacturer would send unwholesome goods to this country if they were liable to ignominious destruction after their arrival. Such goods would not be manufactured for foreign markets if they were liable to inspection, seizure, and destruction, before the cargo could obtain clearance. If, under international law, poisoned goods designed for human use are not contraband of commerce, then pirate-ships have a right to sail the seas.

The manufactures of the nation inaugurating such

a system would be at a premium throughout the commercial world. After the first great step had been taken by the national power, States would find it easy to complete the good work within their own borders. The result would be improved commerce, protection to life and health, and a reflex education of the people to honest ways.

LXXXII.

Tens of thousands of citizens are employed by the General Government in its civil service. Federal legislators, judges, custom-house officers, postmasters, heads of departments, and other dignitaries, must occupy such buildings as the Government supplies. Regiments of clerks, in various places, toil for the people in rooms which not unfrequently are ill-ventilated, badly warmed, overcrowded, or infected with the gases of decomposing filth. It is bad economy in the nation to subject its servants to unwholesome conditions. Congressmen, slowly dying with polluted air in the Capitol, sometimes utter contemptuous language against public hygiene, while they are trembling on the verge of the grave as victims of sanitary apathy. Nearly every public building in Washington is a costly monument to hygienic negligence, indifference, or ignorance. Many millions have been spent by the Federal Government upon imposing structures in other cities, which, so far as healthfulness is concerned, are a national shame. A bureau, presided over by a sanitarian learned in the difficult science and more diffi-

cult art of ventilation, and practically skilled in wholesome ways of drainage, should have hygienic supervision of all national buildings. A nation is not wise that allows its laws to be made and administered by men whose brains are poisoned with the vapors of organic decay.

LXXXIII.

It can not be supposed that official investigators will supersede great pathologists at the centers of science in the civilized portions of the world. Exact facts, however, must be collected before the causes of epidemics can be fruitfully studied. A powerful government is the best agent for co-ordinating the efforts of individuals, and for extending skilled observation to fields beyond the reach of private means. And the governing agency alone can apply on a large scale and enforce regulations for preventing and arresting epidemics. As Dr. Alfred Carpenter says, in a recent address before the Sanitary Institute of Great Britain: "Our domestic animals fall an easy prey to every kind of epidemic. . . . We can not remove disease from our midst, or reduce our death-rate much below seventeen in the one thousand, until we can insure a more healthy progeny among our domestic animals." Epidemics will not cease among men till they cease among the animals on which men feed. It will require the heavy hand of the Federal Government to suppress the national traffic in diseased animals and unwholesome meats.

LXXXIV.

Hand in hand with the prudent administration of a wise sanitary code, must go on the work of the hygienic education of the people. Lord Derby, speaking from ripe experience in the government of an independent people, truly says: "No sanitary improvement worth the name will be effective, whatever acts you pass, or whatever powers you confer upon public officers, unless you can create an intelligent interest in the matter among the people at large. The state may issue directions, municipal authorities may execute to the best of their power, inspectors may travel about, medical authorities may draw up reports, but you can not make a population cleanly or healthy against their will, or without their intelligent co-operation. This is why, of the two, sanitary instruction is even more important than sanitary legislation."

LXXXV.

A State Legislature is supreme, except in such matters as have been delegated by the Constitution to the National Government. The provisions of a State sanitary code may, therefore, be as extensive as protection to the public health may require. Good sense, reasonable prudence, and exact hygienic science, are the only things that the Legislature needs to consult. Experience proves that the people are always ready to sustain measures that promote the general welfare. The public never complains of reasonable sanitary

regulations. On the contrary, complaints are loud, and sometimes threatening, when nuisances are neglected and epidemics are left to multiply their victims. Show the people a sensible way of shielding themselves against things that disturb their comfort, injure their health, and threaten their lives, and they will heartily and promptly bestow the authority, and contribute the means of securing a desirable end.

LXXXVI.

An elaborate measure to protect the people of the State against pretenders to medical knowledge and surgical skill is not desired by a majority of the more thoughtful members of the profession. Neither is such a measure desired by the people. If a citizen wishes to be physicked and have his broken bones set by a quack, the State may act wisely in not interfering; but the assumption of the title "doctor" by a quack may deceive the citizen, may lead the citizen to employ the quack without knowing that he is such, and should therefore be prohibited. People in haste for a physician frequently stop at the first sign proclaiming that a Dr., or an M. D., has his office within. It is the duty of the governing agency to see that no false signs of that kind are hung out. The British registration law of 1858 is based on the sound principle that "it is expedient that persons requiring medical aid should be enabled to distinguish qualified from unqualified practitioners." Compel the quack to announce to an afflicted world that *Mr.* So-and-so

bleeds, pukes, purges, cuts off legs, sets bones, rubs, magnetizes, sweats, etc., and thus prohibit him from deceiving those who are in quest of a real doctor. If people knowingly prefer the quack, let them have him. The quack, like the regular practitioner, should also be held strictly accountable to the law of malpractice. When the quack is denied the right to enforce the collection of his fees, is prohibited from testifying as an expert, is forbidden to proclaim himself, by any device whatsoever, as a doctor, and is civilly and criminally held responsible for doing his work with the average knowledge and skill of the profession in his neighborhood, then let him take his crooked chance in the world. He may at least be of some use as a fool-killer.

LXXXVII.

The Government of England, beginning more than a quarter of a century ago, has enacted the undisputed conclusions of sanitary science into law. For this reason, the hygienic condition of England is superior to that of any other country. In this country there is very little administration of sanitary law, except in the leading cities. The people of these cities have experienced the benefits, and would not, if they could, go back to the almost fruitless days of mere sanitary teaching and preaching. They are not satisfied with talk about public health, but demand that something should be perpetually done to protect it. No community can live by preaching alone. The

morality, the sense of justice, that is born of public teaching, must be embodied in jurisprudence, must be translated into law to be enforced by the aggregate power of organized society. Whatever will not bear such a transformation at the hands of the legislator is wanting either in definiteness or in reality.

The reason for carrying the conclusions of sound sanitary science up into the crucial region of administered law is not far to seek. The author of the health primer entitled "Premature Death" says, in golden words: "In dealing with the personal care of health, it has become customary to treat of man as if he were an abstract personage, capable of procuring for himself, and doing for himself, all that was necessary for the maintenance of his corporeal and mental well-being; he is taught the qualities of good and of bad air, of good and of bad water, of the requirements of wholesome houses, of the characteristics of healthful food, of the due regulation of exercise and habits. He is taught all these things, not as vague generalities, but as matters of precise knowledge which involve a high degree of moral responsibility in their application. All this is an essential part in the great process of health-education now going on, and is producing excellent and progressively increasing results. But this teaching has been, and is still, too much dissociated from the actual facts of the circumstances under which man lives in a civilized country. The vast majority of individuals are dependent for the sort of air they breathe, the water they drink, the homes they inhabit, the food they consume, the opportuni-

ties of relaxation they may have, and even of the habits they form, upon others, and they can bring to bear but an infinitesimal influence over these all-important elements of their physical welfare. How many of us can exercise the slightest control over the qualities of the water we drink, or of the air we breathe, the construction of the houses we inhabit, the quality of the food we have to eat, or our physical habits? We are, for the most part, the slaves of our purse and our occupation, and unable to help ourselves in these matters, except as we act together as a community. It is at this point where our ordinary health-teaching mainly fails, namely, in neglecting to show the circumstances under which individuals can only obtain sanitary essentials by conjoint action, as a community, and to what extent and in what matters the Legislature has made provision for such conjoint action. The chief impediment to sanitary progress at this moment is the want of a just knowledge of the relations of the community to sanitary work, and the consequent misapprehensions of individuals and the insensitiveness of communities on this subject. What is now mainly wanted, in view of the furtherance of sanitary work, is an acuter sense among individuals generally of their common rights and common powers in sanitary matters."

The only way to bring to bear the power of the community for the benefit of its individual members is by the enactment and administration of law.

LXXXVIII.

Drinking-water, like Cæsar's wife and boiled eggs, should not only be good but above suspicion. Water constitutes nearly three fourths of the weight of the human body. "Water," says Professor Huxley, "gives fullness and flexibility to the softer tissues, and is the great agent of movement within the system. It performs the same office of transportation and exchange in the vital economy that it does by oceans, rivers, and canals, in the commerce of the world. Nutritive substances can not enter the system, nor the *débris* of the tissues leave it, except in a state of solution; it is the office of water to bring them into this condition, and to convey them to their various places of destination." High authorities attribute one third of the diseases that afflict humanity to the use of impure water. Dr. Parkes, at the close of a long discussion on the deleterious effects of impure drinking-water, comes to the following general conclusions:

"1. An endemic of diarrhœa in a community is almost always owing either to impure air, impure water, or bad food. If it affects a number of persons suddenly, it is probably owing to one of the last two causes, and, if it extends over many families, almost certainly to water. But as the cause of impurity may be transient, it is not always easy to find experimental proof.

"2. Diarrhœa or dysentery constantly affecting a community, or returning periodically at certain times

of the year, is far more likely to be produced by water than by any other cause.

"3. A very sudden and localized outbreak of either typhoid fever or cholera is almost certainly owing to introduction of the poison by water.

"4. The same fact holds good in cases of malarious fever, and, especially if the cases are very grave, a possible introduction by water should be carefully inquired into.

"5. The introduction of the ova of certain entozoa by means of water is proved in some cases, is probable in others."

LXXXIX.

Vital statistics are still of great value after all possible deductions are made on account of inaccuracies. Careless physicians and ignorant quacks will return, under proper pressure of law, at least the whole number of deaths, with statements of age, sex, and nativity. The average mortality of a community, with its more obvious conditions, may thus be determined with precision. It is not necessary to dwell upon the importance of a reliable death-rate. And it so happens that the diseases which are most influenced by sanitary administration are easily recognized. A death from small-pox is never attributed to any other cause. Nearly every mother of a family knows scarlet fever as well as the doctor. Diagnosis of diphtheria baffles few except those perverse or wicked practitioners who wish to avoid reporting it to the health authority.

Consumption is sadly familiar in most households, and its presence is known without the intervention of a learned pathologist. Remote causes of premature death may be beyond the ken of the medical layman and the ordinary doctor, but it is not necessary to throw away vital statistics because they are not perfect. It would be unwise to throw away all statutes because legislation has not reached an ideal standard. Science should not be abandoned because it has not explored all the secrets of nature. There is much that is extremely valuable in vital statistics, although the defects in returns of the causes of mortality wring words of regret and impatience from the wisest and best sanitarians.

XC.

It is well enough in this country to take cognizance of what is regarded in Great Britain as the proper education of a health-officer. The requirements of the University of Edinburgh do not differ from the requirements of other institutions of learning in the kingdom, and are as follows: *Bachelor of Science.*— 1. The candidate must be a graduate in medicine of a British university, or of such colonial, Indian, or foreign university as may be specially recognized by the University Court. 2. He must be matriculated for the year in which he appears for examination. 3. If the candidate have not passed an *annus medicus* in the University of Edinburgh, he must, before presenting himself for examination, have attended in the

university at least two courses of instruction, scientific or professional, bearing on the subjects of the examinations. 4. There are two examinations for the degree of Bachelor of Science in the Department of Public Health. A candidate who has passed the first examination may proceed to the second at the next period fixed for this, or at any subsequent examination. 5. The candidate must produce evidence that, either during his medical studies or subsequently, he has attended a course of lectures in which instruction was given on public health; and that he has studied analytical chemistry practically for three months with a recognized teacher. 6. The examinations are written, oral, and practical, and are conducted by university examiners selected by the University Court. 7. The subjects of the examination for the degree of Bachelor of Science in the Department of Public Health are as follows:

First Examination.—1. *Chemistry.*—Analysis of air, detection of gaseous emanations and other impurities in the atmosphere; analysis of water for domestic use, and determination of the nature and amount of its mineral and organic constituents; detection, chemical and microscopical, of adulteration in articles of food and drink, and in drugs; practical examination, including at least two analytical researches. 2. *Physics.*—Hydraulics and hydrostatics, in reference to water-supply, drainage, and sewerage; pneumatics, in relation to warming and ventilation; meteorological observations; mensuration, in reference to the plans and sections of public and private buildings, mines, water-

works, and sewers. The candidate must make figured sketches of models. 3. *Sanitary Law.*—Knowledge of the leading sanitary acts of Parliament. 4. *Vital Statistics.*—Knowledge of statistical methods and data in reference to population, births, marriages, and deaths. An oral examination, and an examination in practical chemistry in the laboratory, will take place a few days after the written examination.

Second Examination.—1. *Medicine.*—Origin, nature, and propagation of epidemics and contagious diseases; prevention of contagion and infection; endemic diseases, and the geographical distribution of disease; insalubrious trades; overcrowding, epizoötics, including pathological changes. 2. *Practical Sanitation.*—Duties of a health-officer in reference to water-supply; insalubrious dwellings and public buildings; removal and disposal of sewage and other refuse and impurities, cemeteries, nuisances from manufactories, etc.; bad or insufficient supplies of food; outbreaks of zymotic diseases; quarantine; disinfectants and deodorizers; construction of permanent and temporary hospitals.

Doctor of Science.—A Bachelor of Science in the Department of Public Health may, after the lapse of one year, proceed to the degree of Doctor in the same department, on producing evidence that he has been engaged in practical sanitation since he received the degree of Bachelor of Science, and on producing a thesis on some subject embraced in the Department of Public Health. Every such thesis must be certified by the candidate to have been composed by himself,

and must be approved by the examiners. The candidate for the degree of D. Sc. must lodge his thesis with the Dean of the Medical Faculty on or before January 31st, in the year in which he proposes to graduate. No thesis will be approved which does not contain either the results of original observations on some subject embraced in the examination for B. Sc., or else a full digest and critical exposition of the opinions and researches of others on the subject selected by the candidate, accompanied by precise references to the publications quoted.

The following are recommended as books to be studied in preparation for the above examinations: Parkes, E., "Practical Hygiene"; Wilson, George, "Hand-Book of Hygiene"; Smith, Edward, "Manual for Public Officers of Health" and "Hand-Book for Inspectors of Nuisances"; Michael, Corfield, and Wanklyn, "Manual of Public Health," edited by E. Hart; Eassie, "Healthy Houses"; Latham, Baldwin, "Sanitary Engineering"; Law, Henry, "Rudiments of Civil Engineering"; Monro, George, "The Public Health Act"; Buchan, Alexander, "Introductory Text-Book of Meteorology."

Seventeen out of the twenty great universities of Germany are now giving courses of instruction in state medicine. The medical schools of the United States are sadly behind the times in neglecting to teach hygiene.

However well trained a health-officer may be, he must deal hard blows, not only to secure any advancement in sanitary work, but even to maintain the dig-

nity of his position against traditional prejudice and conceited presumption. As Dr. Billings sarcastically says: "Among architects, engineers, lawyers, and politicians, a feeling is very common that the sanitarian should confine himself to the pointing out of the evils to be remedied; that he should be a sort of inspector of nuisances, with sufficient knowledge of medicine to give a name to the evil results observed, and that he should leave to them, with their special and superior knowledge, the task of remedying these evils. This plan has been very thoroughly tried, and the results are not satisfactory—in fact, the prevalence of this idea has been one of the causes of the slow progress of hygiene."

APPENDIX.

WHEN the chapter on cholera in this book was written, Dr. Koch had not yet returned from India, and the results of his investigations were unknown. The very remarkable paper, read recently before a select audience of scientists at Berlin by Dr. Koch, is too long and too exclusively addressed to the profession to be inserted here. In the opinion of Professor Virchow and of other competent judges, the paper of Dr. Koch marks the beginning of a new epoch in the history of cholera. In order to give readers some notion of the discovery and views of Dr. Koch, I reproduce here the following clear and accurate summary from the "British Medical Journal":

"Of course, the whole point turns on whether Dr. Koch has made out that the comma-bacillus is really the cause of the disease. In order to demonstrate that a given bacterium is the cause of a disease, it must be proved—1. That a special bacterium, with definite characteristics marking it out from other forms of bacteria, is constantly present in the parts affected; 2. That this bacterium is present in sufficient numbers to account for the disease; 3. That it is not similarly associated with other diseases; 4. That this bacterium can be cultivated apart from the body, and that its introduction into the lower animals

is followed by the same effects as the introduction of the infective material itself. With regard to the first, second, and third points, Dr. Koch gives a definite and perfectly satisfactory answer. He finds a bacillus (the comma-bacillus) constantly present in the affected parts (the intestinal tract), and always in sufficient numbers to account for the disease. This bacillus has definite characteristics which mark it out from all other known bacteria. It is not so much by its form and microscopical appearances that it is to be distinguished, as by its mode of growth in cultivating-materials rendered solid by the addition of gelatine. This is a point which requires the most careful attention by those who will, no doubt, engage in control-observations. Dr. Koch has failed to find in other diseases micro-organisms presenting all the characteristics of the cholera-bacillus; but, no doubt, organisms of a curved shape, presenting the microscopical appearances of the comma-bacillus, will be found in fæces and other materials. It does not, however, follow that it is the organism described by Koch in connection with cholera. Before this can be stated it must be cultivated, and its cultivation in gelatinized materials must show the appearances described by Koch.

"The answer to the fourth point is what it ought to be, though it is not satisfactory. The introduction of the comma-bacillus into the lower animals is followed by the same result as the introduction of the infected material itself (fæces), the effect in most instances being none. This result is, of course, unsat-

isfactory in one way, because, till an animal is found which will take cholera, the absolute proof that the comma-bacillus is the cause of cholera can not be furnished; but the result is satisfactory, in that in this point also the comma-bacillus agrees in its action with cholera-stools. Had the comma-bacillus produced disease where cholera-virus did not, the idea that the comma-bacillus is the virus of cholera would, of course, be untenable.

"The question is, whether this evidence is sufficient to show that the comma-bacillus is the cause of cholera or not. Standing by itself, it is undoubtedly insufficient; but when considered in connection with known facts with regard to other infective diseases, the view becomes highly probable, and, no doubt, almost certain to most of those who are thoroughly acquainted with these researches. In every single instance in which infective diseases have been found to be communicable from animal to animal, it has been demonstrated that, when micro-organisms are constantly present at the seat of the disease in sufficient numbers to account for the disease possessing definite characteristics marking them out from other micro-organisms, and not present in other diseases, these micro-organisms are undoubtedly the cause of the disease.

"In the diseases not communicable to the lower animals (typhoid fever, leprosy, etc.), few who have studied them doubt that the special organisms found in them are the true cause; and why should this doubt be greater in cholera than in other instances? Koch

looks on the experiments made by Richards, and which have been brought forward by some writers in opposition to Koch, as in reality in favor of his views on the etiology of cholera, as showing that the comma-bacilli produce a toxic substance in the intestinal canal.

"The facts which Koch has made out with regard to the rapid death of the bacilli on drying are, according to him, in accordance with many known facts on the spread of cholera. Whether there may not be a permanent or spore condition is a point which can not, however, be regarded as settled by his experiments. Various facts seem to point to the existence of spores—among others the passage of the bacillus through the gastric juice without sustaining injury.

"Dr. Koch hopes that the presence of the comma-bacillus may be of service in diagnosing Asiatic cholera, more especially in the early cases, in any given place. For this diagnosis, however, cultivation-experiments are indispensable, and few have either the knowledge or the conveniences to enable them to carry this out. No doubt, should Koch's experiments be confirmed, some steps will be taken, in places threatened with an epidemic, to have means at hand for the satisfactory and rapid determination of the diseases in suspicious cases. At the present time, if the discharges from suspicious cases were forwarded for examination to those who are interested in this work, much useful knowledge might be gained, and early intimation of the existence of the disease be obtained."

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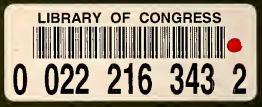
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